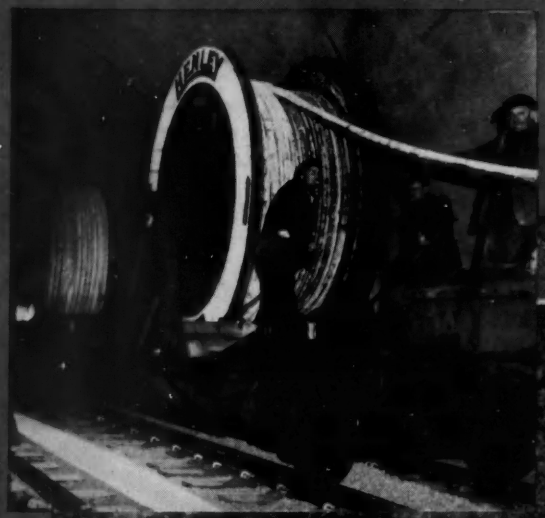
30 SEPTEMBER 1954 NINEPENCE

ELECTRICAL TIMES



MANCHESTER-SHEFFIELD-WATH
RAILWAY ELECTRIFICATION SCHEME

HENLEY have supplied and installed approximately 35 miles of 33 kV 3-core screened S.L. type single wire armoured and served cables for this important railway electrification scheme.
The illustrations show 33 kV feeders being installed in Woodhead Tunnel.

HENLEY CABLES

BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

Let Henley Cables carry the current

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD. 51-33 HATTON GARDEN, LONDON, E.C.1

THE MICANITE & INSULATORS COMPANY LIMITED

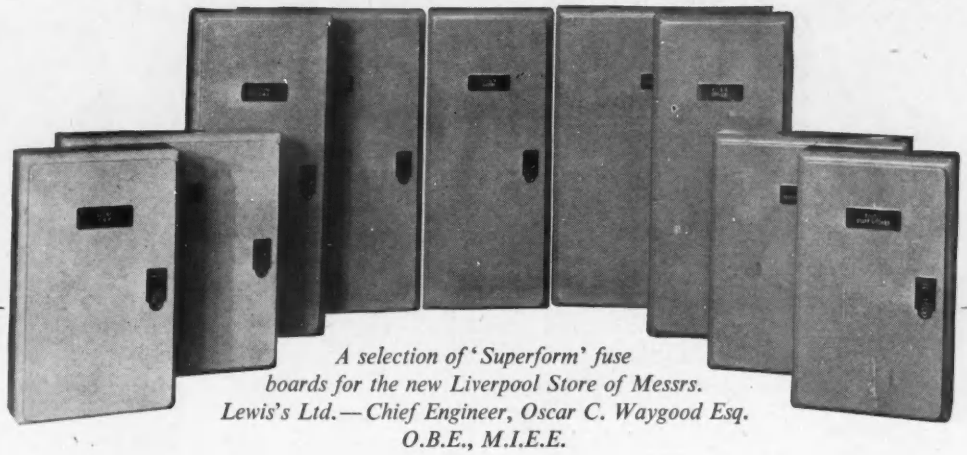
EMPIRE WORKS · BLACKHORSE LANE · WALTHAMSTOW · LONDON · E.17

BRANCH OFFICES AT BIRMINGHAM · CARDIFF · GLASGOW · MANCHESTER and NEWCASTLE-UPON-TYNE and representatives in most countries throughout the world. In CANADA, MICANITE CANADA LTD.

Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. PANILAX Laminated Materials and Mouldings. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS & TERMINALS. Distributors of Micoflex-Duratube Sleevings, Micoflex-Durasleeve (Plastics-covered flexible metal conduit), Durajoint (Patented expansion jointing for concrete structures) and Kenutuf Injection Mouldings (in most thermoplastics including P.V.C.)

'SUPERFORM'

Distribution Fuse Boards



A selection of 'Superform' fuse boards for the new Liverpool Store of Messrs. Lewis's Ltd.—Chief Engineer, Oscar C. Waygood Esq. O.B.E., M.I.E.E.

'ENGLISH ELECTRIC' takes the lead in distribution fuse board design with the introduction of the new 'Superform' range.

Smooth in contour and with no external projections, the 'Superform' fuse board has spring-loaded door fitted with resilient grummet and the door catch (cylinder lock optional) is push-button operated.

This new range is specially suitable for hospitals, stores, hotels, laboratories, schools and similar buildings.

Write today for descriptive publication FG/125.

'ENGLISH ELECTRIC'

fusegear

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Generating Plant — Steam, Hydraulic, Gas Turbine or Diesel. Transformers, Rectifiers, Switchgear and Fusegear. Industrial Electrification. Electric and Diesel-electric Traction. Marine Propulsion and Auxiliaries. Aircraft. Aircraft Electrical Equipment. Industrial Electronic Equipment. Instruments. Domestic Electrical Appliances. Television Receivers.

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

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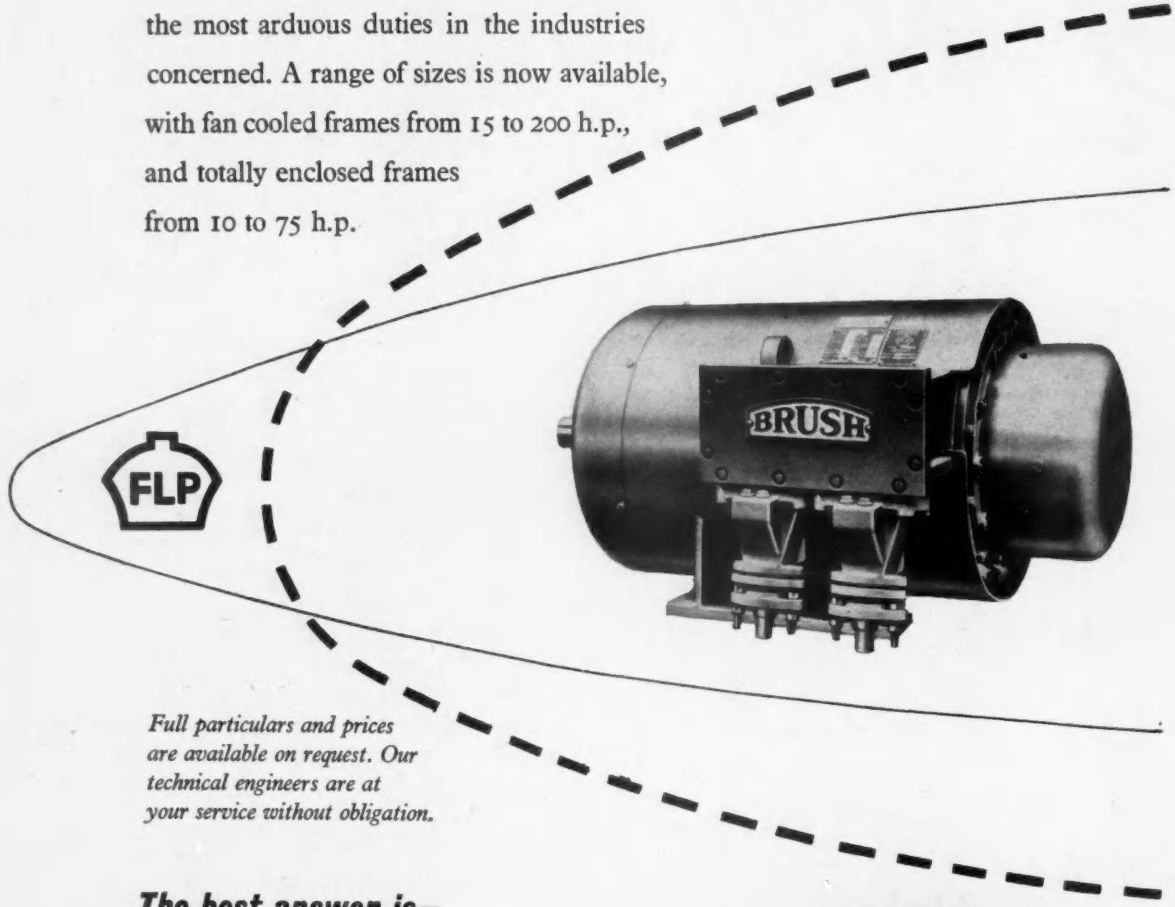
F.12

A

Where there is danger in the air

TO MEET THE DEMAND of the mining and other industries for electric motors to drive machinery used in inflammable gaseous atmospheres — BRUSH has enlarged its range of flameproof motors which are built to British Standards and Buxton Tested. They will withstand the most arduous duties in the industries concerned. A range of sizes is now available, with fan cooled frames from 15 to 200 h.p., and totally enclosed frames from 10 to 75 h.p.



Full particulars and prices are available on request. Our technical engineers are at your service without obligation.

The best answer is—

Flameproof motors by BRUSH

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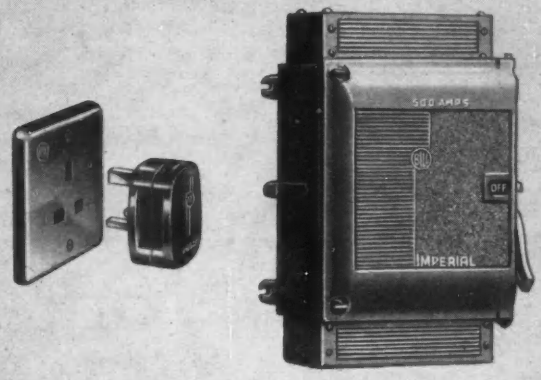
B.36

You cannot buy better gear



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13 AMP SOCKET OUTLET TO 500 AMP FUSE SWITCH

★ SOCKET OUTLETS
★ COOKER SWITCHES
★ DISTRIBUTION BOARDS
★ SWITCHES AND SWITCH FUSES
★ INDUSTRIAL PANELS

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P & G is on his track!

He comes up to town on the 8.15 in the morning and catches the 5.20 for home at night. But what he does not know is that P & G is watching over him. For P & G Batteries provide the current for switchgear operation and supervisory control on his railway line. The 60 years of P & G experience cover a vast and varied field in electricity supply—including batteries for generating stations and substations, railway electrification work, emergency lighting, telephone electricity supply. If you have a project, discuss it with our specialists. Our 3-point service covers (1) Technical Advice and Specification (2) Equipment and Installation (3) Regular Inspection and Report.

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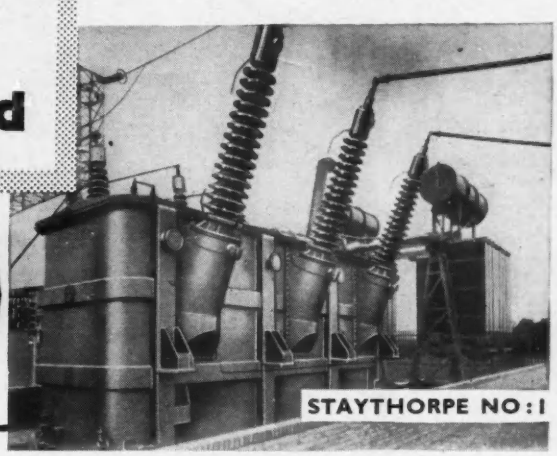
120 MVA TRANSFORMERS

for the

275 kV British Supergrid

The first of ten BTH transformers for the BEA supergrid was transported to site early in 1953 and was officially commissioned in July of that year.

IN SERVICE

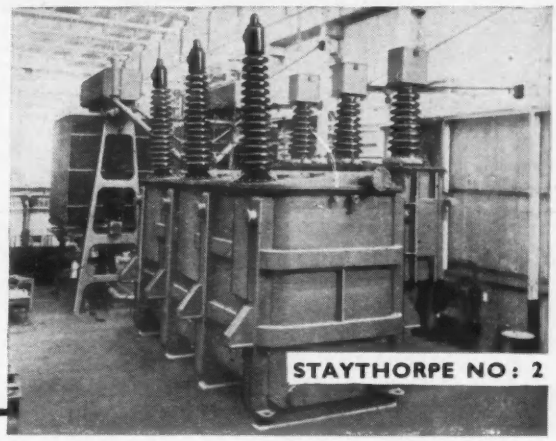


STAYTHORPE NO: 1

READY FOR SERVICE

This transformer is now on site, having passed satisfactorily all specified tests including :—

Heat run at full-load losses.
Induced voltage tests at 460 kV to earth and 550 kV between phases.
Impulse tests on 275 kV windings at 1050 kV.
Impulse tests on 132 kV windings at 550 kV.



STAYTHORPE NO: 2

The two transformers for West Melton Substation are now under construction at Rugby. No. 1 has its core and windings assembled, while the core of No. 2 has been laid down.

IN PRODUCTION

WEST MELTON NO: 1

WEST MELTON NO: 2

B T-H

BRITISH THOMSON-HOUSTON

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED · RUGBY · ENGLAND

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Clyde SOOT BLOWERS
BOILER AVAILABILITY INCREASED
ELECTRO-MECHANICAL OPERATION with SEQUENCE CONTROL

Improvements Over Manual Operations

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NOT EVEN . . . A SCREWDRIVER!

Just a flick of the thumb and . . . the fuse is ready for changing

No chance of interference with wiring
Complies with B.S.S. 1363
Specify the D.S. 16 Plug and D.S. 17 Socket
The Socket with the Porcelain back

COMPETITIVE PRICES

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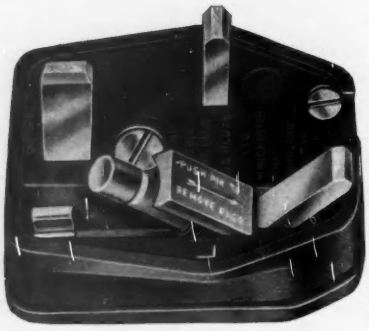
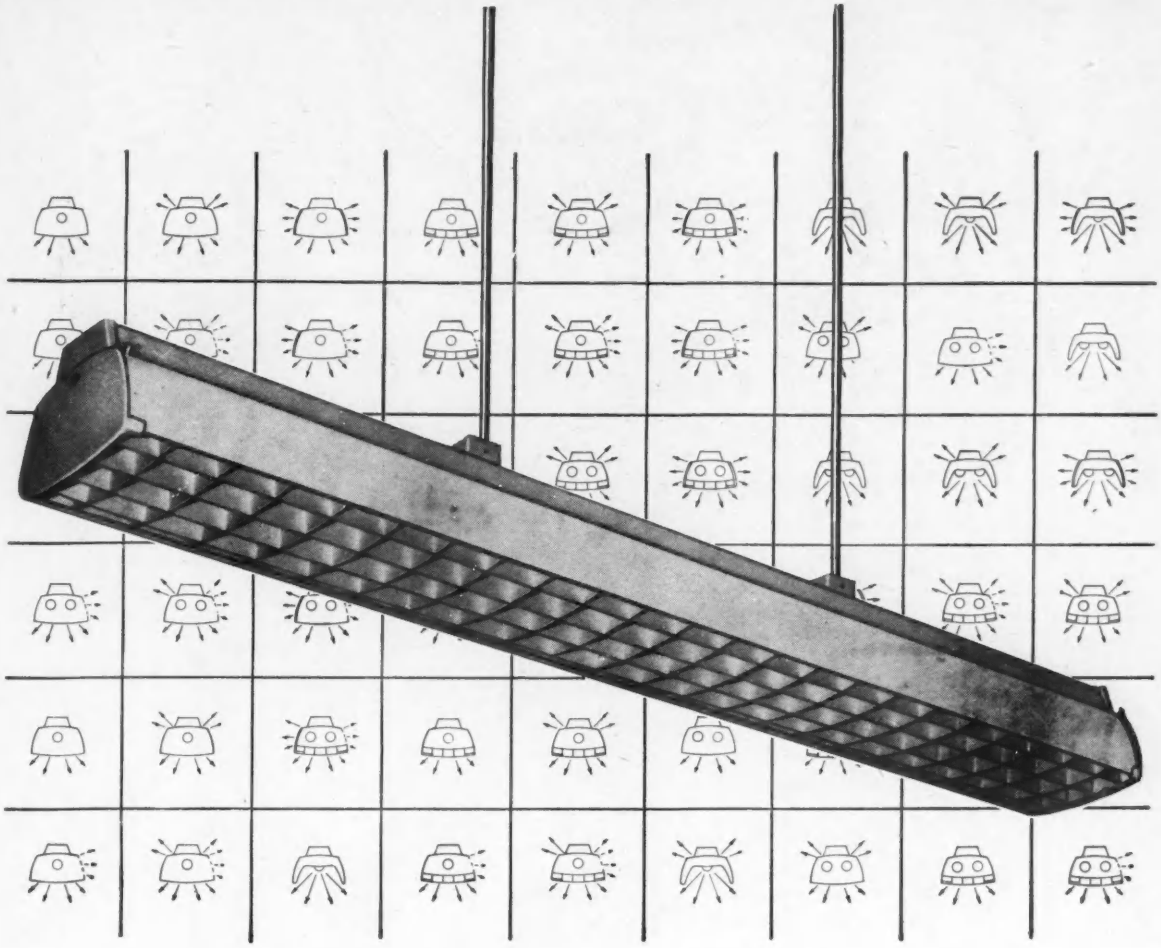
MANCHESTER · 5



London Office and Export Division:—
DORMAN HOUSE, 10, EMERALD STREET, LONDON, W.C.1
Member of the Dorman Smith Group of Companies



One to fifty-four fittings

Here is something entirely new in industrial lighting. The Crompton 'New-Range' fittings have been designed to fill the long-felt wants of fluorescent lighting users and incorporate many improvements and innovations that have been suggested to us by the users themselves. They offer a means whereby no less than FIFTY-FOUR different fittings may be speedily built up from one foundation unit, so that every contingency can be met. The 'New-Range' fittings are silent in operation and incorporate the famous Crompton visible starter, or snap-start gear. Reflectors are finished in 'Permawhite', vitreous enamel or 'Perspex'.

Write now for full informative literature or call in the advice of one of our industrial lighting experts.

BY APPOINTMENT MANUFACTURERS OF ELECTRIC LAMPS TO THE LATE KING GEORGE VI

Crompton 'NEW-RANGE'

The lighting fittings you helped to design

ELECTRICAL EQUIPMENT

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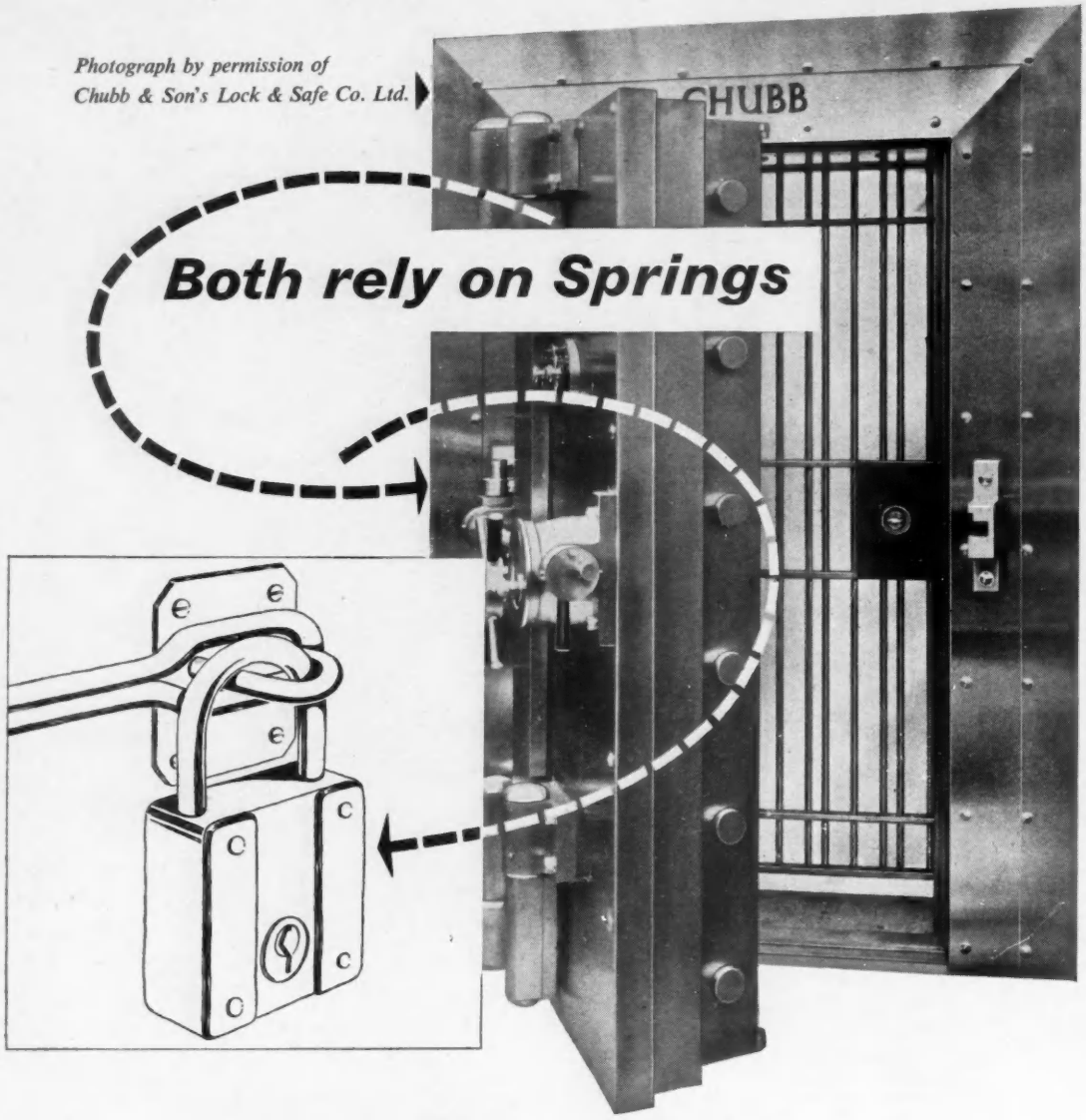

Both rely on Springs

reliable Springs by

From the high precision spring required for a strongroom door to its simpler counterpart in a padlock, the right spring for the job is essential to ensure perfect performance. When your springs are designed and made by Salter, they are just right — not the cheapest obtainable but fit to work for ever.

SALTER

Service to Engineers since 1760

A tradition of quality in craftsmanship and materials is embodied in every Salter spring — you can depend on Salter for the *right spring for the job.*

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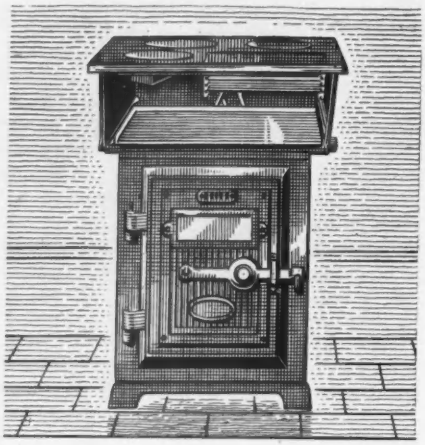
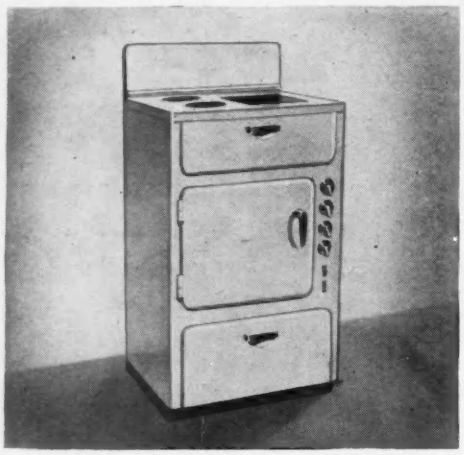
VACTITE WIRE COMPANY LTD.
75, St. Simon Street, Salford 3, Lancs.

Progress in design





Since the early days of domestic electrical heating a great deal of research has been done. The result : the Brightray series of nickel-chromium resistance materials — outstandingly reliable, and with special grades to suit all domestic and industrial applications. Let us help you select the one most suitable for *your* requirements.

BRIGHTRAY C for intermittent heating and cooling cycles up to 1150°C: particularly suitable for fires, irons, cookers, heating plates, etc.

BRIGHTRAY S for electric furnace elements working almost continuously at temperatures up to 1150°C.

BRIGHTRAY B for all types of element where temperature does not exceed 950°C.

BRIGHTRAY F for furnace elements operating in a carburising atmosphere not above 1000°C.

WOULD YOU LIKE A HANDBOOK . . .

containing complete data on our electrical resistance materials? We will gladly send it free of charge on hearing from you on your business letterhead.

BRIGHTRAY reliable HEATING ELEMENTS

'Brightray' is a registered trade mark.

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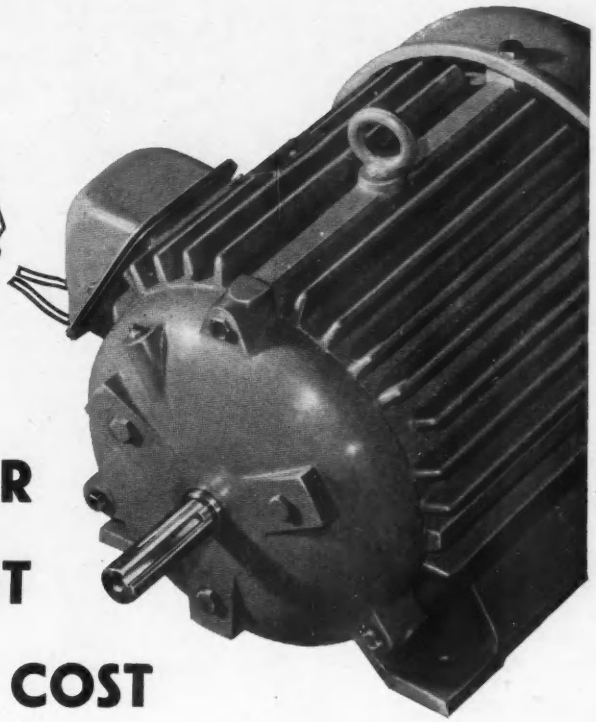
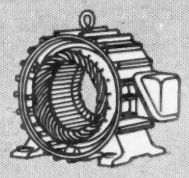
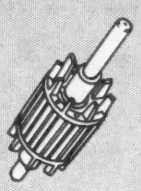
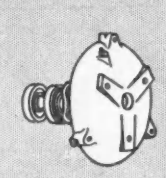
FACTS ABOUT ELECTRIC MOTORS

TOTALLY ENCLOSED FAN COOLED TO BRITISH STANDARD 2083:1954



BROOK MOTORS Ltd

TOUGHER
MORE EFFICIENT
LOW IN COST

FRAMES	INSULATION	COILS	ROTOR	BEARINGS
				
Rigid cast iron. Designed to hold bearing alignment and prevent distortion under normal operating conditions. Dust-tight.	Slot design eliminates pockets where dirt can collect. Synthetic resin covered wire enables more copper to be packed in the slots	Continuous wound coil groups assure positive current flow through windings and eliminate the connections between coils.	One-piece indestructible aluminium rotor with integrally cast fan which dissipates heat quickly. Dynamically balanced.	Cartridge type housings with ample grease capacity and felt seals.

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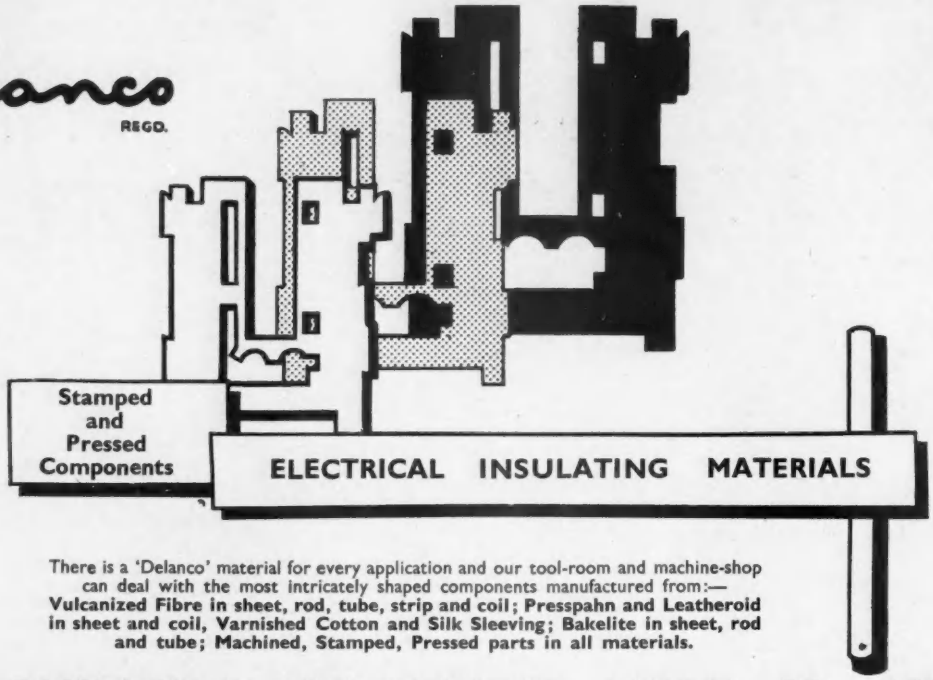
Delanco
REGD.



There is a 'Delanco' material for every application and our tool-room and machine-shop can deal with the most intricately shaped components manufactured from:—
Vulcanized Fibre in sheet, rod, tube, strip and coil; Presspahn and Leatheroid in sheet and coil, Varnished Cotton and Silk Sleeving; Bakelite in sheet, rod and tube; Machined, Stamped, Pressed parts in all materials.

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LIGHTING FITTINGS
(Watertight, Weatherproof, also Decorative)
INDICATOR FITTINGS
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also GLASGOW, LONDON *and* NEWCASTLE-ON-TYNE

RED HOT NEWS

FERRANTI

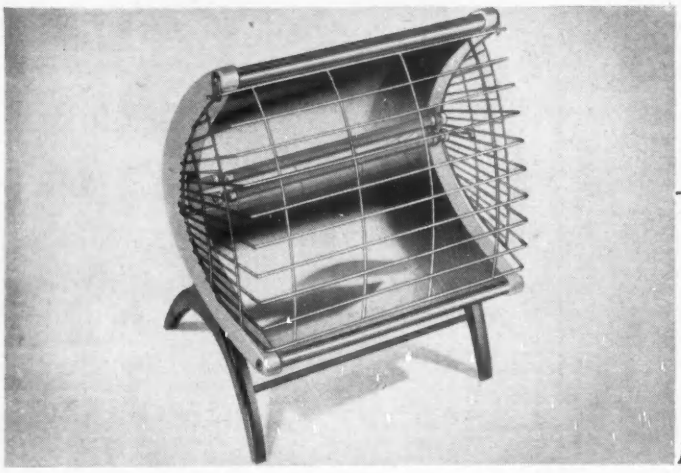
Additional FERRANTI fires to increase your sales!

4144: Cream enamel castings and chrome reflector. Dimensions: Height 11¾″; Width 12½″; Depth 7½″; Weight 4 lbs. 6 ozs. PRICE **£3 12s 10d** (tax paid) 1000 Watts.

4140: Cream enamel castings with brown legs. Reflector in chrome or Solium. Dimensions: Height 15¼″; Width 13″; Depth 9½″; Weight 8 lbs. 4 ozs. PRICE **£8 17s 6d** (tax paid) 1000/2000 Watts.

It'll pay to make a note of these two new fires. They are Ferranti radiant fires—long recognised as the best value in electric space heating—and they are selling at really popular prices.

We'll be advertising both models in national papers this winter. Put them in your showroom—and watch the sales go up.



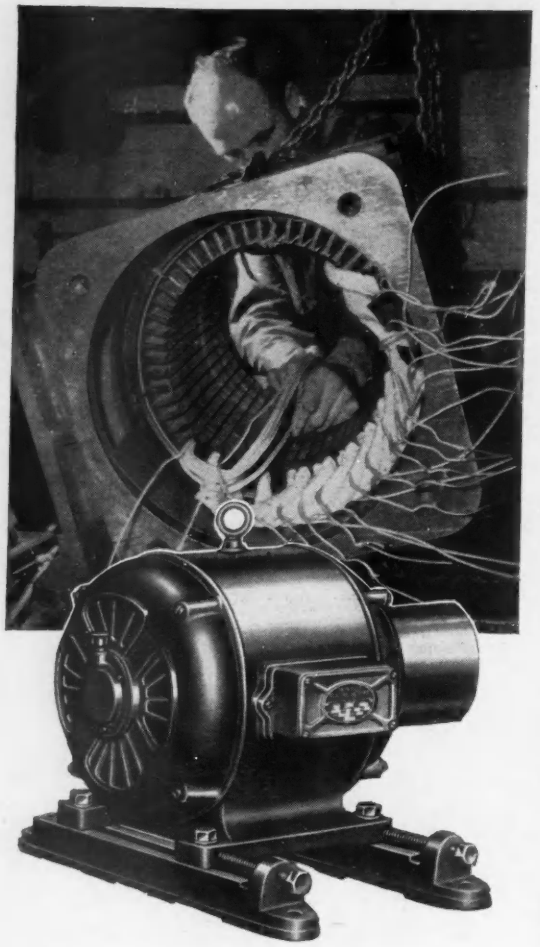
Only FERRANTI radiant fires have all these advantages

1. Pencil-thin high temperature element.
2. Scientifically designed reflector, with element accurately positioned.
3. Beautifully finished—will last a lifetime.
4. Maximum warmth for low power consumption.
5. *Immediate comfort* throughout a wide zone.

FERRANTI radiant electric fires

FIRST — FOREMOST — HOTTEST

FERRANTI LIMITED · MOSTON · MANCHESTER 10



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confidence lies behind the guarantee placed on every Howells motor: confidence in the skill of our craftsmen and the efficiency of our organisation: confidence justified by the reputation of our motors for lasting and trouble-free service. There's more than meets the eye in

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Single-phase meters for domestic supplies

The new 'ENGLISH ELECTRIC' single-phase house service meter, type B31B, has been designed to give remarkable accuracy under varying conditions of temperature, voltage and frequency. This B31B meter has uniformity of characteristics and will maintain its initial calibration over long periods of service. It is available in a moulded insulated case and complies fully with B.S. 37 : 1952 for meters with maximum current ratings of 10, 40 or 80 amperes. Approved by The Ministry of Fuel and Power, February 1954.

These meters are fully described in publication MS.2004.

'ENGLISH ELECTRIC'

house service meters

THE ENGLISH ELECTRIC COMPANY LTD. QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Meter Department, Stafford

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

MS.22D4

NEW ELECO "PERSPEX" FITTING FOR INDUSTRIAL CONDUIT LIGHTING

—Increases Light Output Ratio 10-15%

This new Eleco fitting (patent applied for) is efficient, versatile and economical. It can be used either open, or made completely dustproof with a diffusor cover. The reflectors are made in two grades of opal 'Perspex', whilst the covers are obtainable in three grades, including a pinspot pattern "Perspex". This means that a suitable combination can be arranged to control the percentage of upward light and brightness over a considerable area. Thus, units can be selected to give the best lighting effect for your particular installation.

TOTAL THESE FEATURES - AND YOU GET TODAY'S MOST EFFICIENT LIGHTING

For 100 to 500 watt tungsten Lamps, 80-125 watt MB/V Mercury.

Lighting output Ratio exceeds 85%. Balanced distribution — 10-25% upward light.

High mechanical strength — Resists corrosion.

Low initial cost.

Ease of installation.

White stove enamelled interior.

For further particulars or help on any lighting problem write to:

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ENGINEERING & LIGHTING EQUIPMENT CO. LTD.

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wash boilers
new editions of
a famous range

VERSCO SQUARE BOILER

VERSCO ROUND BOILER

VERSCO SQUARE DE LUXE BOILER. This smart and compact boiler is fitted with castors for easy movement and is finished in cream stove enamel. The table-top in cream vitreous is an attractive feature.

VERSCO ROUND BOILER. Obtainable in Galvanised finish as shown (a most durable finish of special appeal for Corporation and other housing schemes) or in cream stove enamel.

THESE FEATURES ARE COMMON TO ALL VERSCO MODELS: Heavily tinned 10 GALLON copper container —Double pole 3 heat rotary switches A.C. or D.C. (safety cut-out available if required)—Chromium plated taps with heat-resisting handles—Six 500 W clamp-on elements give maximum loading of 3 Kw.—Top surrounds in die-cast aluminium and pressed aluminium loose lids for easy access.

Send for new leaflet giving full specifications and prices.

SWIRLUX

WASHING MACHINES

500H MODEL heats the water, 6 lb. dry weight capacity, 12" wringer which folds down when not in use. Exclusive Swirlux agitator. (Unheated version 500 MODEL also available.) 503 MODEL— 10/11 lb. dry weight capacity, full size power wringer with five working positions. Exclusive Swirlux agitator. Power pump and hose for quick emptying. For full details send for Swirlux Leaflets.

Universal Boilers & Engineering Co. Ltd., Fulledge Works, Burnley, Lancs.
TELEPHONE: 3121 and 3203

mdb 3406

MARDRIVE REG'D

CLUTCH WORM REDUCTION UNIT

The Mardrive clutch worm reduction unit is invaluable for low speed drives where it is necessary to start and stop instantly and at more frequent intervals than is possible by direct switching of the motor.

The unit has simple, adjustable, belt tension between the unit and the driven member.

By the use of varying ratios of worm reducers a speed range of from 10 r.p.m. to 115 r.p.m. is readily attainable and with variations of the pulley sizes, this range can be further increased.

These fractional horse-power units are readily available for use on single-phase, three-phase or D.C. electrical supply.

The unique qualities of the MARDRIVE clutch worm reduction unit make for elimination of fatigue and an increase in both quality and quantity of production.

The MARINE ENGINEERING COMPANY (STOCKPORT) Ltd
BULKELEY STREET · EDGELEY · STOCKPORT

we make ONLY electric water heaters but we DO make them WELL

The Sadia 'Select' is the latest product of the only specialists in electric water heating. 30 years of experience in this field are built into the Sadia Range of Electric Water Heaters, both large and small.

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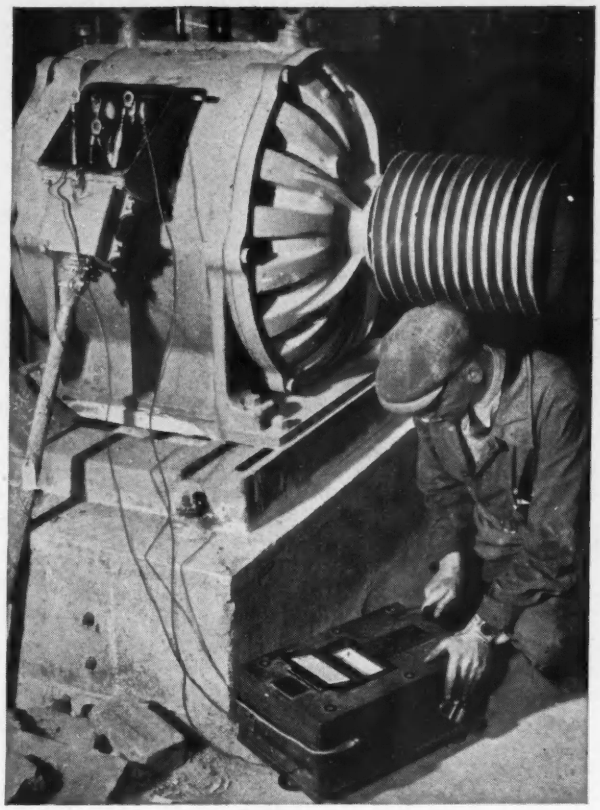
Hot Water by Electricity

AIDAS ELECTRIC LTD., SADIA WORKS, ROWDELL ROAD, NORTHOLT, GREENFORD, MIDDX.
Phone: WAXLOW 1607

Agents for Scotland:—W. Brown & Co. (Engineers) Ltd., 89 Douglas Street, Glasgow, C.2.

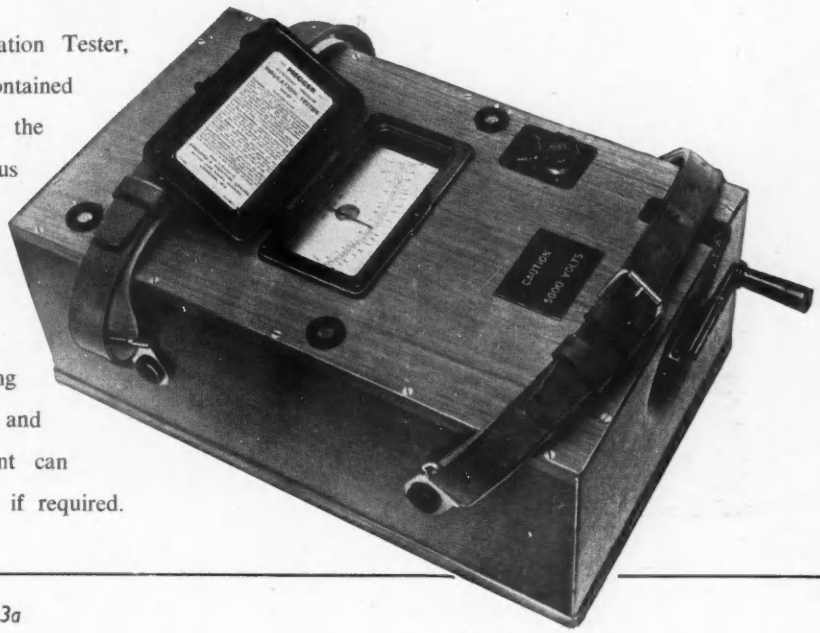
Manufactured in S. Africa by:—Sadia Water Heaters (Pty) Ltd., 3-5 Newton Street, Village Main, Johannesburg.



5,000 VOLT MEGGER INSULATION TESTER

being used on a Fuel Pulveriser Motor at the B.E.A. Generating Station at Uskmouth

The 5,000 volt "Megger" Insulation Tester, Series 1, is a portable self-contained instrument for accurately testing the electrical insulation of apparatus having considerable capacitance. Readings up to 100,000 megohms may be taken: the instrument can also be fitted with a voltage switch enabling tests to be made at 5000, 2500 and 1000 volts. A similar instrument can be supplied for mains operation if required.



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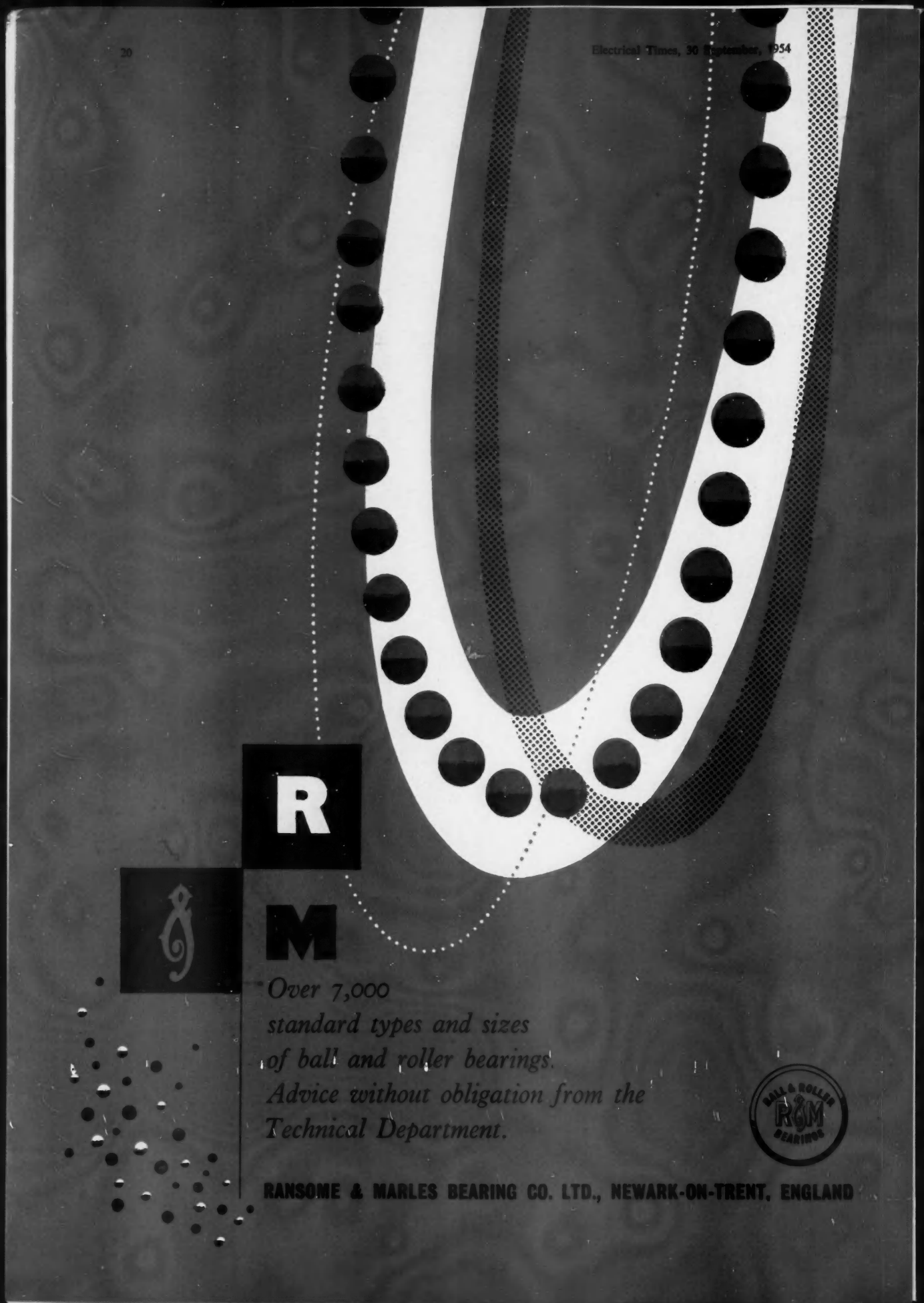
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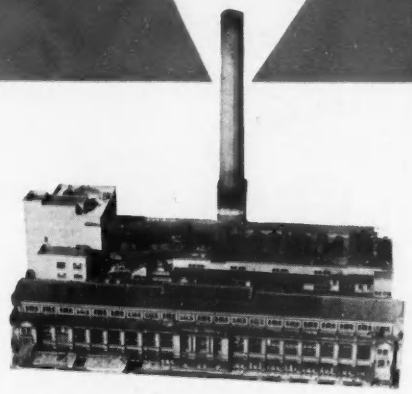
For the first time the British Electricity Authority thermal efficiencies exceed 30%

Highest Thermal Efficiency

Portobello H.P.

30.86%



For the second year running, it was an ICL-equipped generating station which headed the British Electricity Authority Table, with a record thermal efficiency.

Other ICL-equipped stations, high in the list are:—

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LITTLEBROOK B SKELTON GRANGE

Complete steam generation by

INTERNATIONAL COMBUSTION LIMITED

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SG 37

Model 8 UNIVERSAL AVOMETER

20,000 ohms per volt *plus* AUTOMATIC Overload Protection

Produced in response to a demand for a high sensitivity version of the world-famous Universal AvoMeter, this model incorporates the traditional design features of its predecessors, so highly valued for simplicity of operation and compact portability.

It has a sensitivity of 20,000 ohms per volt on all D.C. voltage ranges and 1,000 ohms per volt on A.C. ranges from 100 V upwards. A decibel scale is provided for audio frequency tests. In addition, a press button has been incorporated which reverses the direction of current through the moving coil, and thus obviates the inconvenience of changing over test leads when the current direction reverses. It also simplifies the testing of potentials, both positive and negative, about a common reference point. A wide range of resistance measurements can be made using internal batteries, separate zero adjustment being provided for each range.

It is of importance to note that this model incorporates the "AVO" automatic cut-out for protection against inadvertent overloads.

Size 8½" x 7½" x 4½"
Weight 6½lbs. (including leads)

£23 : 10s.

For your Valve Characteristic Meter or Valve Tester

Owing to the very large number of valves which have been issued within the last two years, no further amendments will be issued for the original "AVO" Valve Testing Manual. A new, completely revised and fully up-to-date Valve Data Manual is now available from the Company at 15/- post free.

D.C. VOLTAGE	D.C. CURRENT	A.C. VOLTAGE	A.C. CURRENT	RESISTANCE
2·5V.	50μA.	2·5V.	100mA.	*First Indication* 0·5Ω.
10V.	250μA.	10V.	1A.	*Maximum Indication* 20MΩ.
25V.	1mA.	25V.	2·5A.	0—2,000Ω { using internal batteries.
100V.	10mA.	100V.	10A.	0—200,000Ω { using internal batteries.
250V.	100mA.	250V.	—	0—20MΩ { using internal batteries.
1,000V.	1A.	1,000V.	—	0—200MΩ { using external batteries
2,500V.	10A.	2,500V.	—	

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
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Installation Costs CUT-

New low-priced 40 Watt 4 ft. Ediswan lighting fitting

Cat. No. LS. 4007

The unit comprises a tapered channel body fitted with die cast ends. Into the top of the channel portion is fitted a sheet metal ceiling plate carrying the control gear.

The ceiling plate and channel are united by captive screws, the heads of which project on the underside of the channel. The sheet metal is pretreated before being finished glossy white stoved enamel.

The Patent "PENDICONE" fixing method enables the unit to be installed very quickly by one man. "PENDICONE" washers (patent applied for) used in conjunction with the two-way key slots in the ceiling plate allow the two c/s ceiling screws to be inserted before the ceiling plate is fixed to ceiling.

Price £5 . 6 . 8 complete with control gear for switch start at 200-250V. 50 cycles.

EDISWAN

Fluorescent Lighting Equipment

Publications No. LE.1763 giving complete details of the 4 ft. fitting and LE. 1703 for the 5 ft. fitting available on request. These fittings are offered for use in situations where bare lamps are acceptable. For the Ediswan range of fittings providing various forms of light control ask for Broadsheet No. LE.1788.

The Edison Swan Electric Co. Ltd., 155 Charing Cross Road, London, W.C.2.

Member of the A.E.I. Group of Companies.

LE 187c

VYBAK insulation for length*-and life

**This armoured signalling cable recently installed at the Bradford Colliery, Lancs, was made in a single length of 1,800 ft.* by the Mersey Cable Works Limited. The cable consists of 72 stranded copper conductors individually insulated with VYBAK compound and arranged in 36 pairs of differing colour combinations to make the pairs readily identifiable, the whole being enclosed in a black VYBAK sheathing further protected with two layers of steel armouring wire.

VYBAK Flexible Extrusion Compounds are tough and hardwearing, with good resistance to fire, abrasion, weathering and most chemicals. A choice is available from a wide range of colours for electrical colour codes or decorative purposes.

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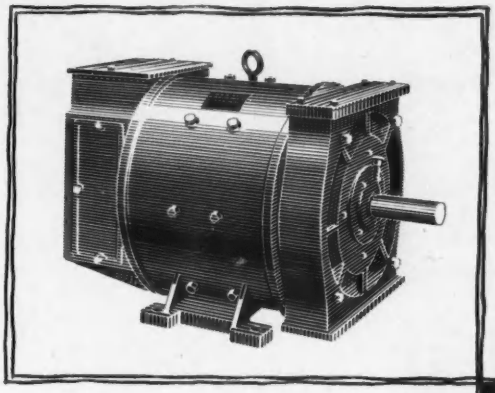
Vybak Products Include: Rigid and flexible PVC compounds for moulding and extrusion; calendered sheet; rigid and flexible pressed sheet—coloured, transparent or translucent; heavy grade industrial rigid sheet; Polymer and Copolymer resins.

VYBAK REGD.

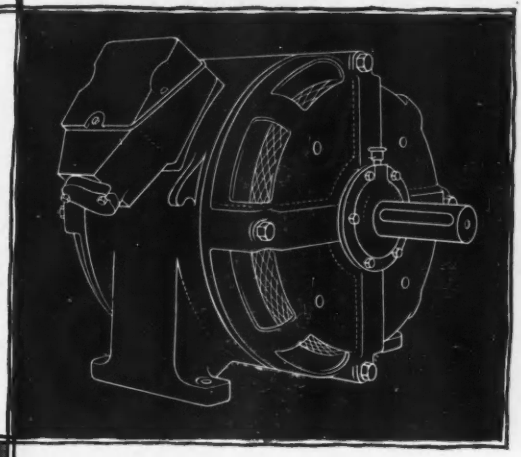
Compounds

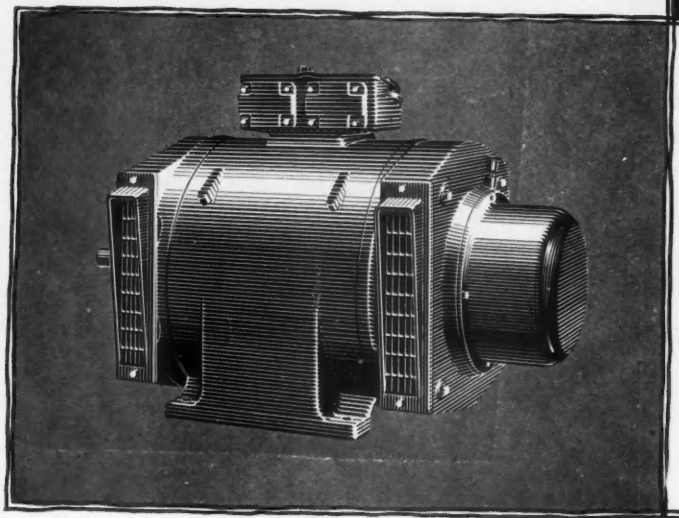
C4



They bear

the name G.E.C.





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It might be *(a)* **Sky high maximum temperature**
= shorter life

It could be *(b)* **Moderate maximum temperature**
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It should be *(c)* **'Nichrome' temperature**
+ 'Nichrome' life

It is an established fact that resistance wires of similar basic composition can have different lives under equivalent conditions of working temperature.

The production of a wire giving long life within its admitted range of working temperature can be achieved only by a specialised melting technique and by strict control in the subsequent processing.

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'NICHROME' up to 950° C.	'NICHROME' V up to 1,150° C.

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Nickel and Nickel Alloy Specialists: for furnace elements, domestic appliances, thermo-couples, telecommunications, lamps, spark plugs, fine wires, etc.

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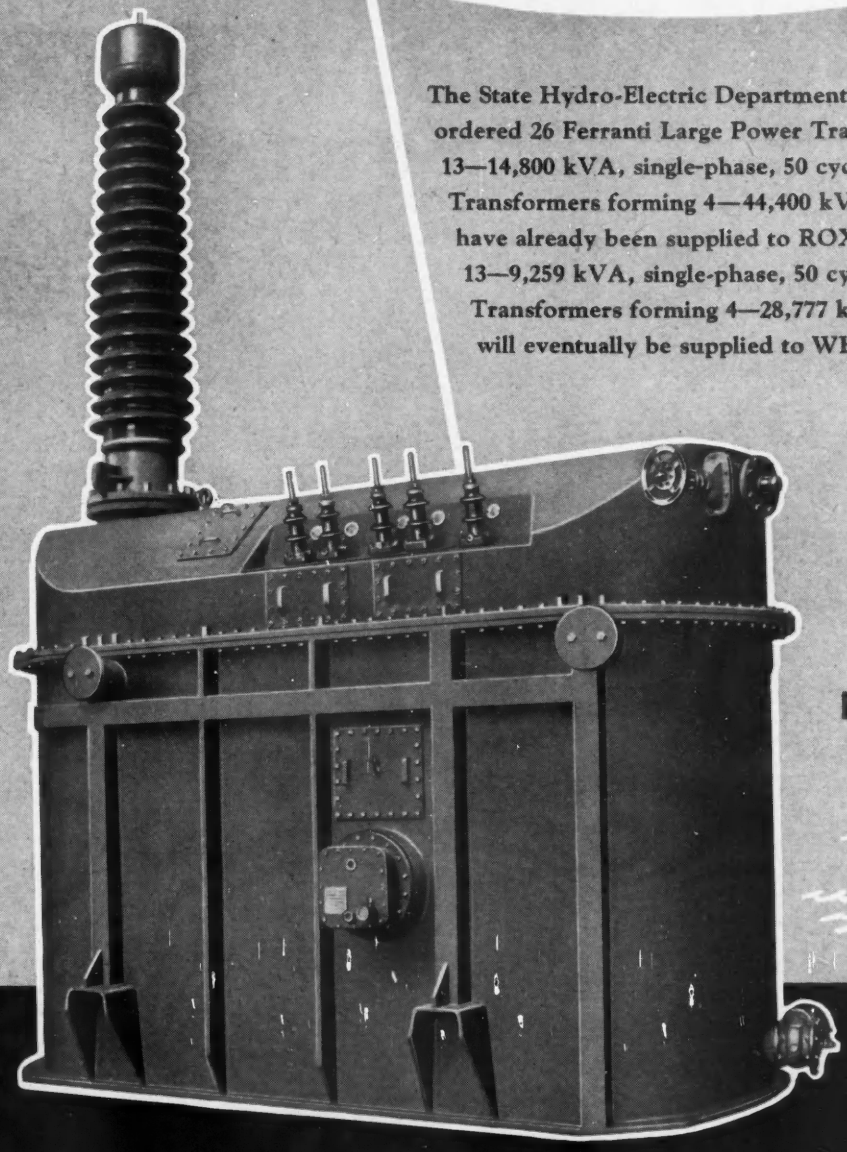
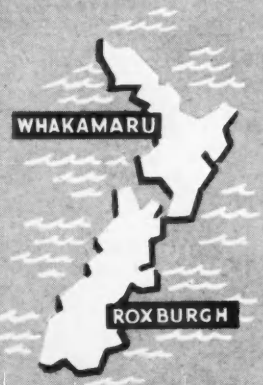
The State Hydro-Electric Department of New Zealand has ordered 26 Ferranti Large Power Transformers.

13—14,800 kVA, single-phase, 50 cycles, 11/220 kV Transformers forming 4—44,400 kVA 3-phase banks have already been supplied to ROXBURGH.

13—9,259 kVA, single-phase, 50 cycles, 11/220 kV Transformers forming 4—28,777 kVA 3-phase banks will eventually be supplied to WHAKAMARU.





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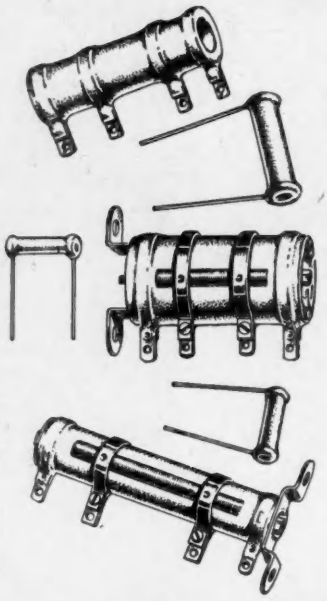
C.R.M. resistors are wound on high grade low loss ceramic tubes. They can be coated with — Silicone Resins — Vitreous enamel or Cement with terminations to suit customers requirements.
C.R.M. resistors have a low temperature Co-efficient of resistance, are of robust construction and can be used under conditions where reliability and stability are important factors.
Good delivery — Low prices.
We shall be pleased to quote for your requirements.



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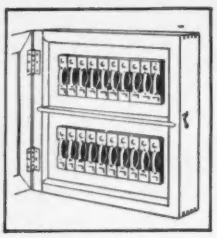
Telephone: VANGE 2[illegible]



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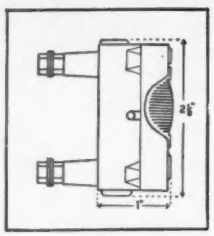

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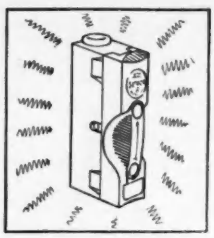

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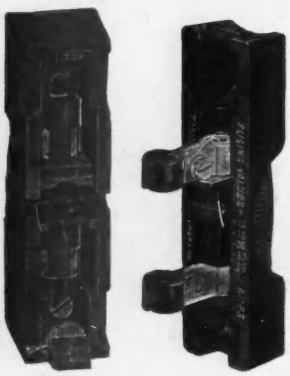
To simplify and protect . . .

Slydlok 5 amp 250 volt fuses afford the designer complete freedom because their ease of wiring, their compactness, and above all their resistance to mechanical shock, enable them to be incorporated wherever convenient. Adaptable for cartridge fuses and neutral links, Slydlok afford protection with simplicity. Write for literature.



SLYDLOK FUSES

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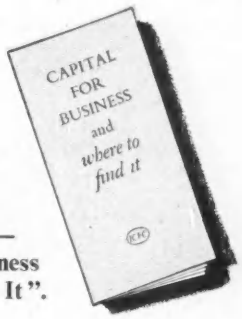
dm EW 4

Wise finance changes the picture

This firm specialises in the manufacture of high-vacuum equipment. ICFC began a series of investments in 1946, when the business was operating in premises such as those shown in the upper photograph. Today the firm is installed in this fine modern factory of 100,000 sq. ft.

ICFC capital has changed the picture for many industrial organisations by financing new buildings, new plant and schemes of general expansion. The Corporation provides finance in the form of long-term loans on fixed terms, or share capital, to industrial and commercial enterprises in Great Britain. Amounts range normally between £5,000 and £200,000. Formed in 1945 by the English and Scottish banks, ICFC has already aided the expansion of British industry by loans totalling over £40,000,000.



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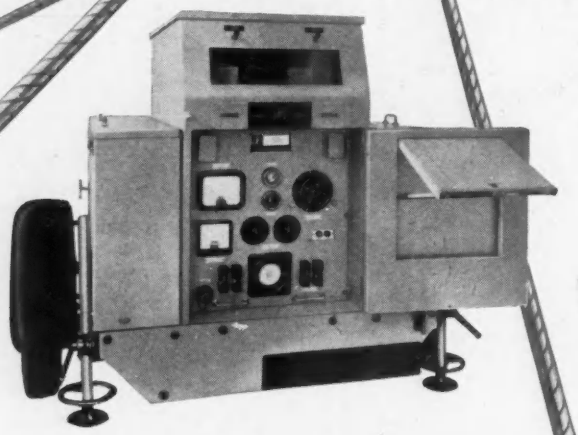
ICFC

P.3

D.C. Tests for H.V. Cables

are more informative



It has repeatedly been shown that D.C. tests will often indicate impending trouble in a cable which has actually survived an A.C. test. Regular D.C. tests for high voltage cables provide information which permits a higher level of maintenance, and thus considerably lengthens the life of a cable.

HERE ARE A FEW MORE of the MANY ADVANTAGES offered by the SenTerCet D.C. Cable Testing Equipment:

- ★ **Provides a highly sensitive check on the presence of moisture in cables, joints and terminations.**
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Bulletin F/CT.1. contains full details of both transportable and trailer-mounted equipments.

SenTerCet
RECTIFIER EQUIPMENT
Registered Trade Mark

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with such Big capacity such a wealth of features such economy in running

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Here it is — the first Cooker in Britain with all these selling points. Never before has a cooker with so many features and *so much capacity* sold for so low a price. Upwards of 50 years' manufacturing experience is behind the Revo Monarch, the Cooker which is outstanding in design and value.

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EYE-LEVEL CONTROLS
out of the children's reach, too.
EXTRA-HIGH SPLASHBACK
clears the tallest domestic utensil.
TWO 8 INCH HOT PLATES
and large grill boiler.
EXTRA-BIG HOT CUPBOARD
takes all the plates and dishes for 5 people
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and separate meat tin. Racks are closer wired.
2960
cu. ins. oven capacity. Loading 2.1 kW.

✲ Splashback housing of switches allows for an oven of 2960 cu. ins. plus servicing from the front.

✲ Identical sheathed tubular elements at side and bottom of oven pack flat, simplify stocking of spares.

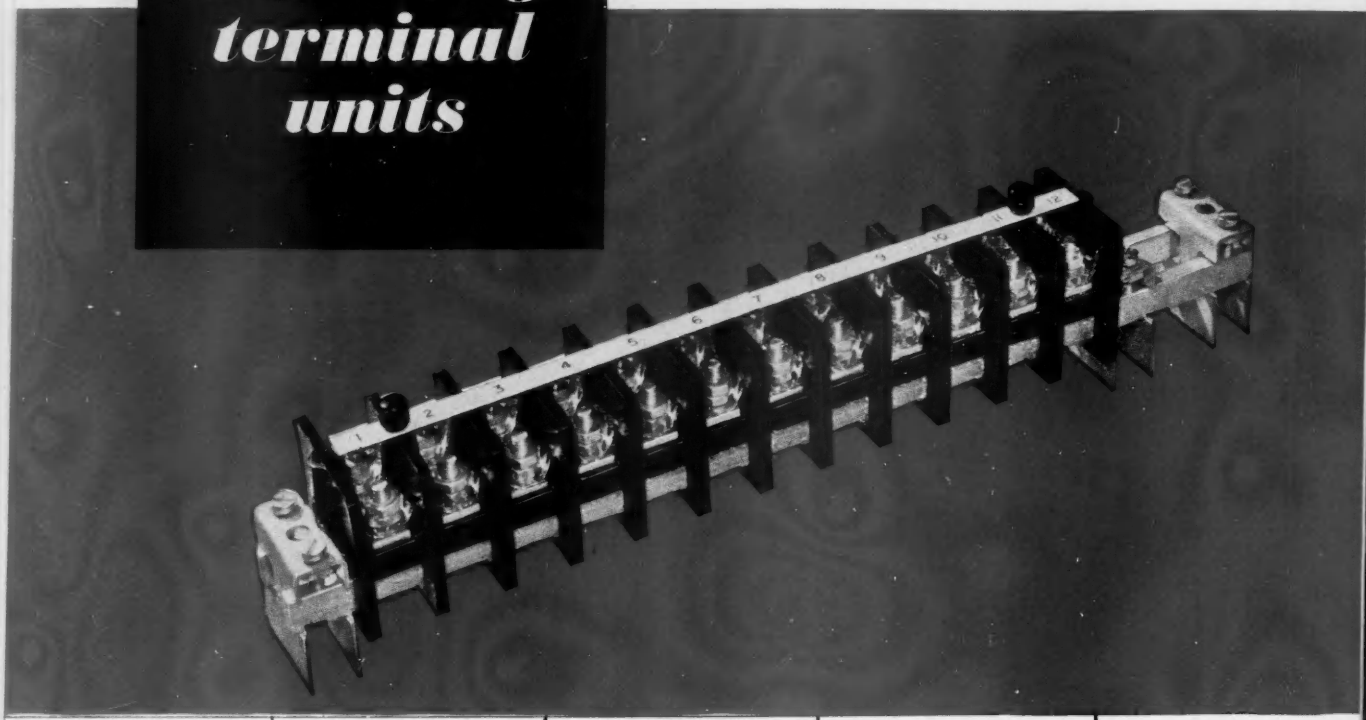
✲ One piece steel body increases earthing efficiency.

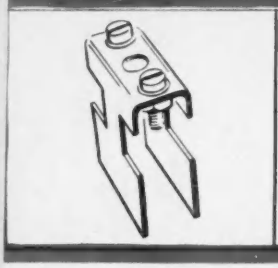
✲ Oven interior removable in 3 pieces for easy cleaning and maintenance.

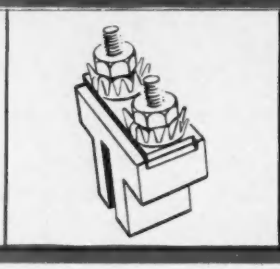
✲ Special construction of oven door minimises condensation.

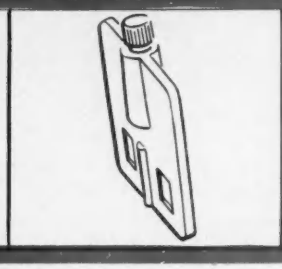
✲ Quick heating-up, only 16 mins. to 350° F.

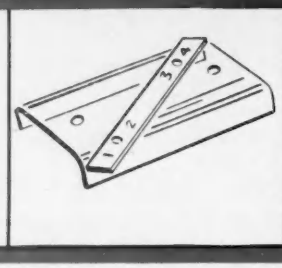
ASTRAL *multiway terminal units*

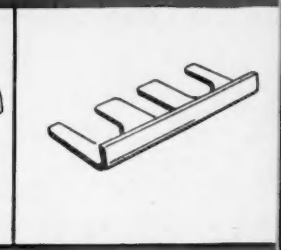












APPLICATIONS Cable terminations, interconnections and testing. L.T. systems, switchboards, control equipment, traction, etc.

DESIGN Any number of terminal ways, built from eight basic types of interlocking components. No live metal underneath, and room to pass cables under. Framework earths. Optional, bridging links, two, three or more ways. Supplied assembled and complete, or in parts to order.

MATERIALS Terminal pillars on solid plates, all nickelled brass, each pair on heavy moulded black phenolic segments, with separate barriers, all locking into position. Cadmium plated steel support bars, brackets and screws. Optional, nickelled copper bridging links.

DIMENSIONS Overall height $3\frac{3}{4}$", width 2". Length, two-way $5\frac{15}{32}$" increasing $\frac{29}{32}$" for each additional terminal way, example, twelve-way $14\frac{17}{32}$". Two $\frac{9}{32}$" fixing holes at centres $\frac{1}{8}$" less than overall length. Steel support bars $\frac{1}{2}$" x $\frac{3}{4}$".

TERMINALS Rating 60A. 660V. Each separate segment has two No. 0 B.A. Pillars, with lock nuts and claw terminals, or cable sockets if specified. Each interlocking segment can be separately removed, for easy connecting.

SHIELD & LABEL Optional. Both separately detachable, secured by insulated screwed knobs. Rigid transparent P.V.C. shield. Ivorine label supplied blank, or numbered lettered per terminal way to order.

INSTALLATION Units up to twenty-four ways, fixed with two No. 0 B.A. cadmium plated screws and nuts, supplied. Behind switchboards, on equipment panels, or mounted in Astral Adaptable or other boxes, cubicles, etc., as desired.

Astral adaptable boxes too

INSTALL

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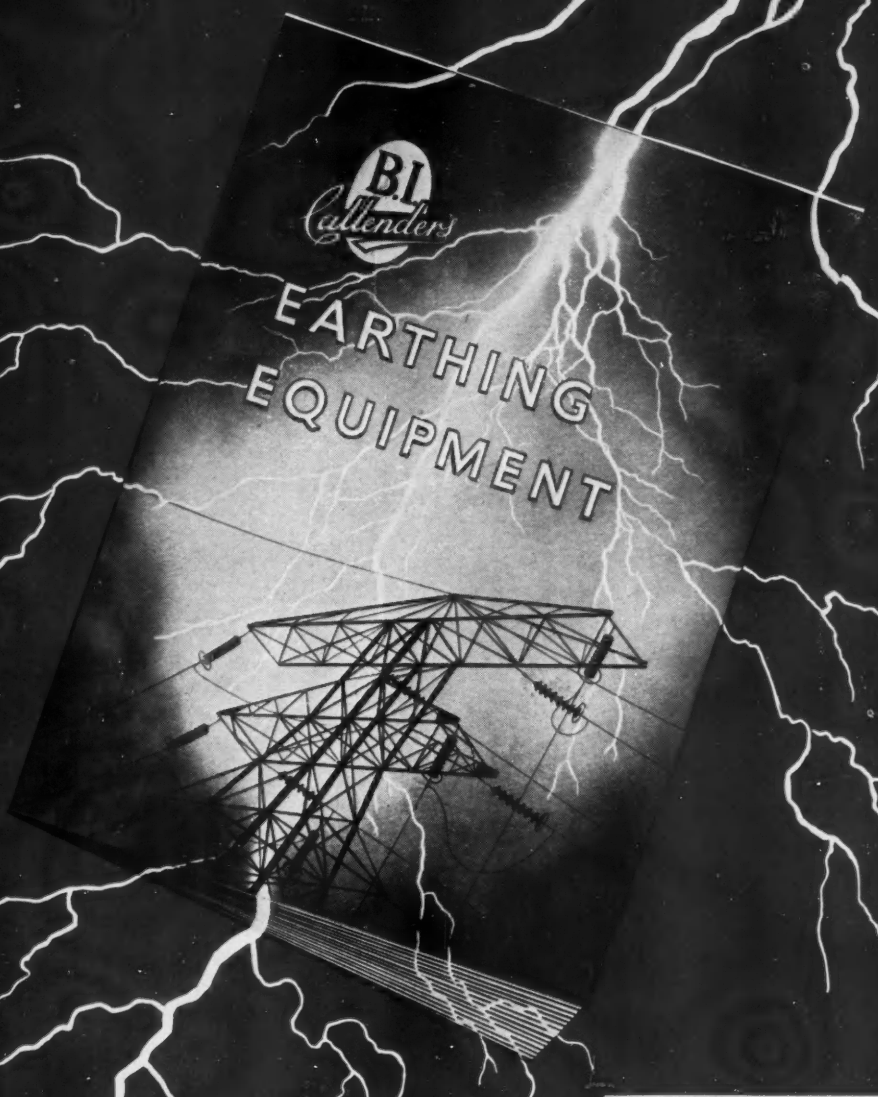

on

BICC EARTHING EQUIPMENT

This Publication (No. 335) contains more than thirty pages of technical information, tables and illustrations covering all aspects of earthing, with a description of modern methods of testing earth resistivity.

Write for your copy to-day.

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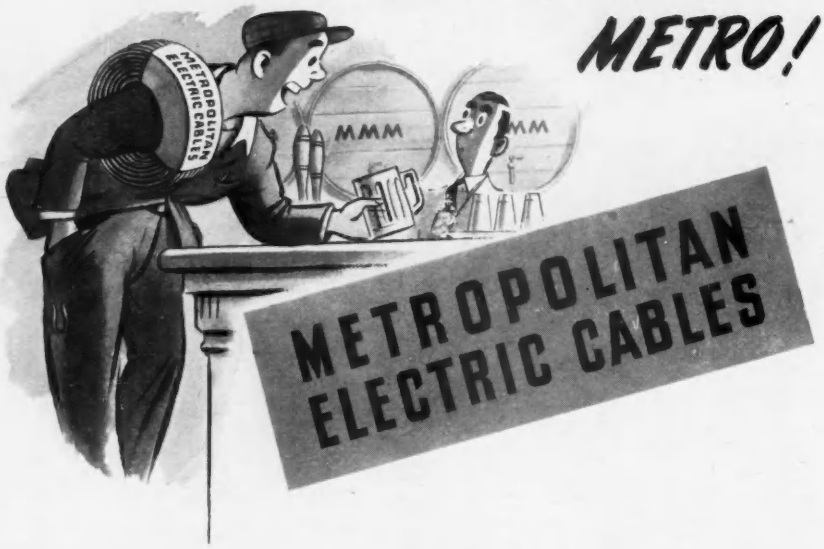

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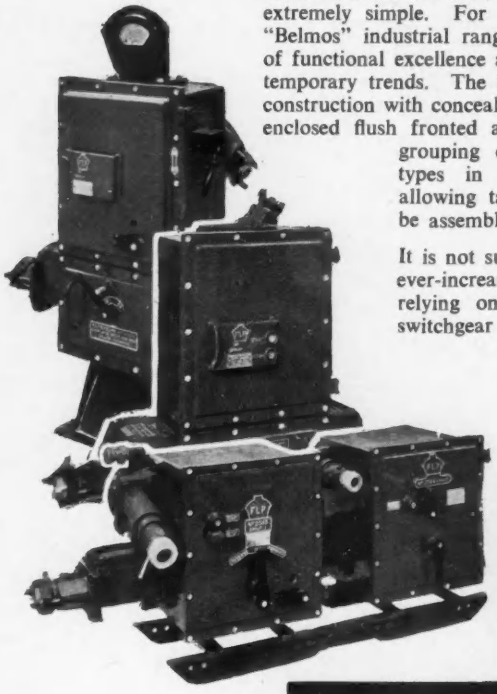

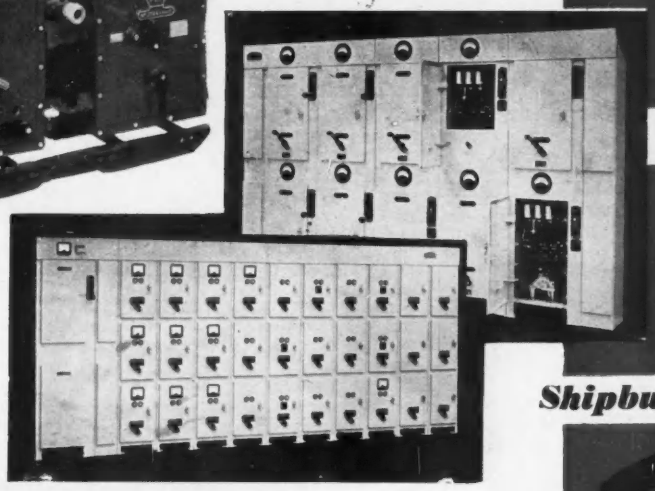

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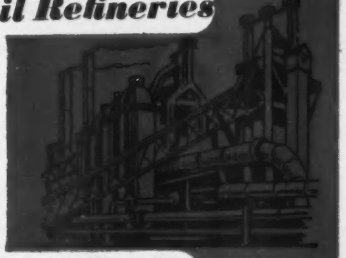

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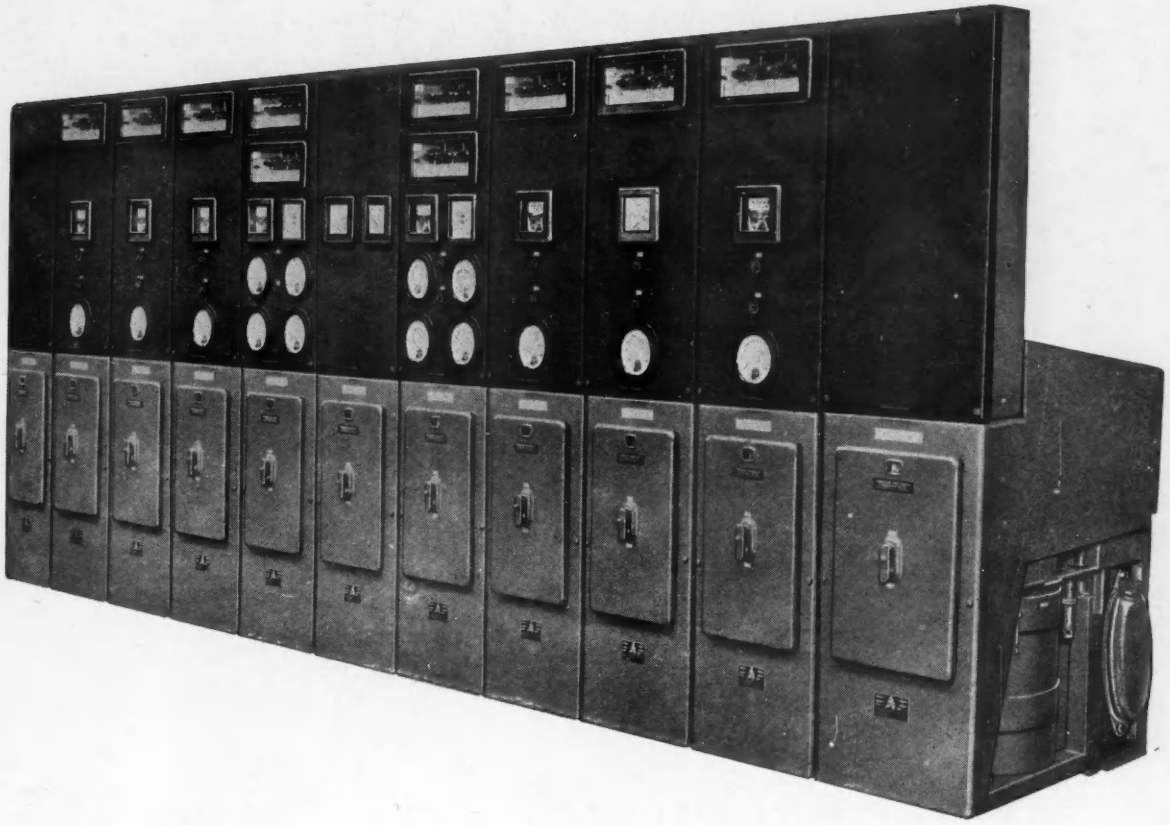

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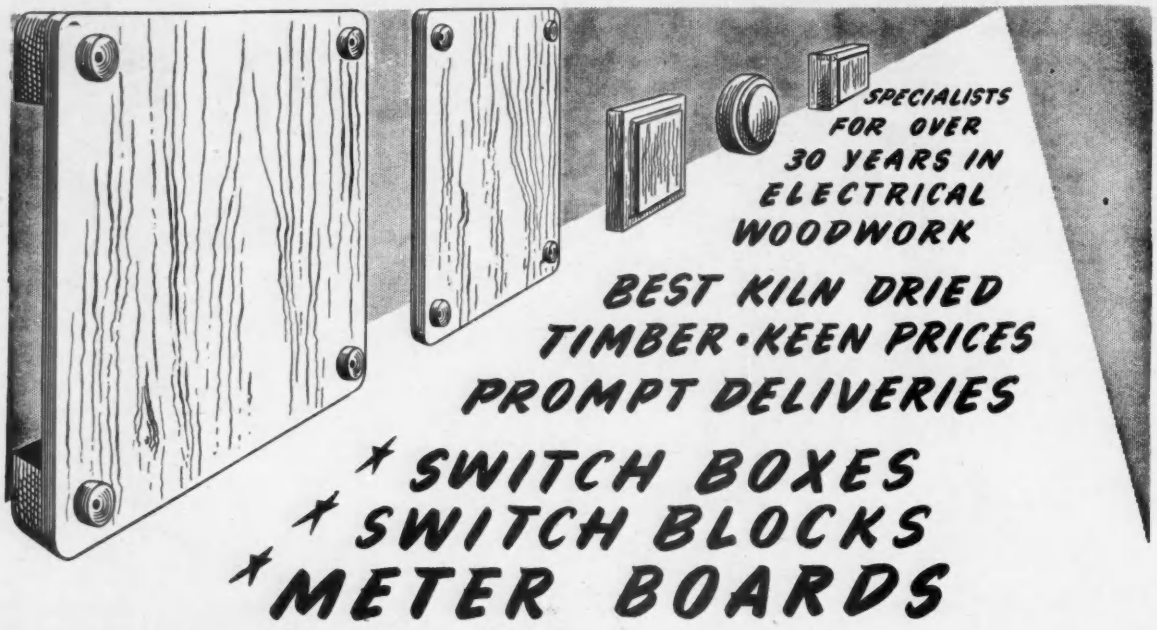

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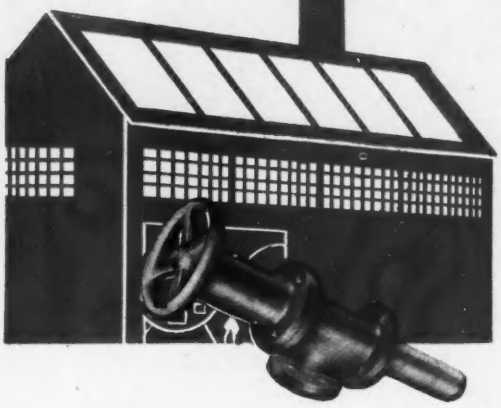

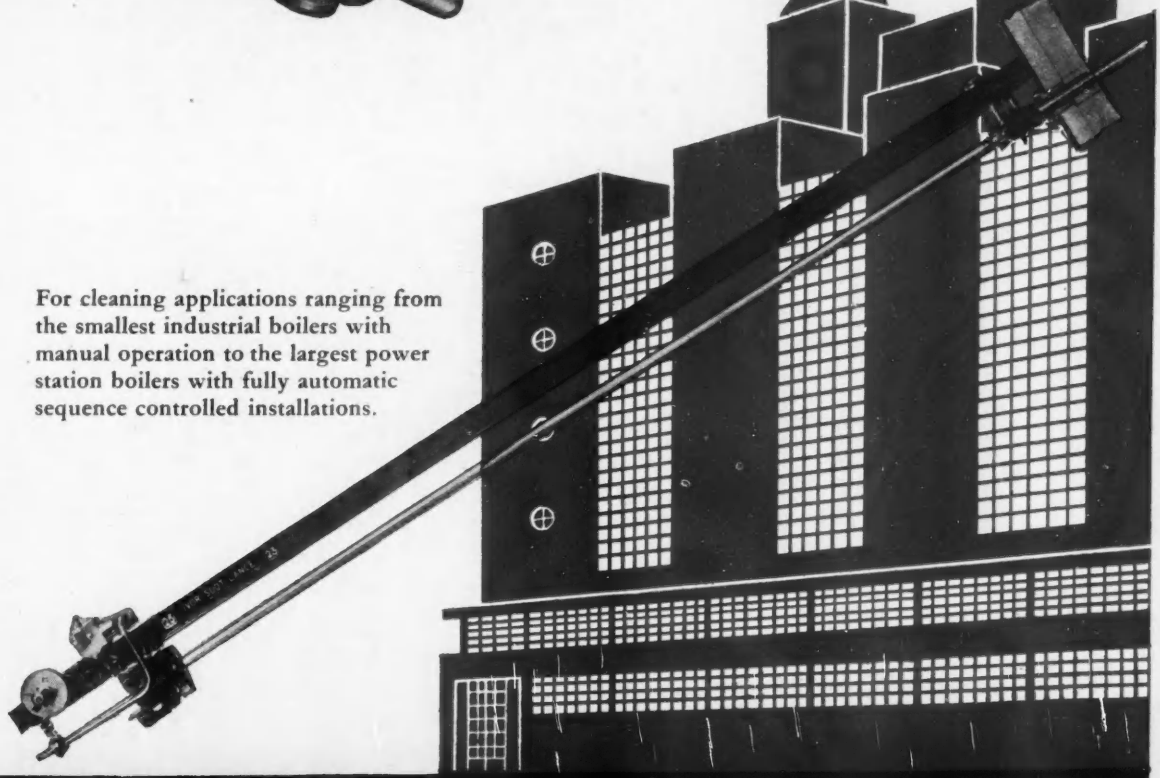

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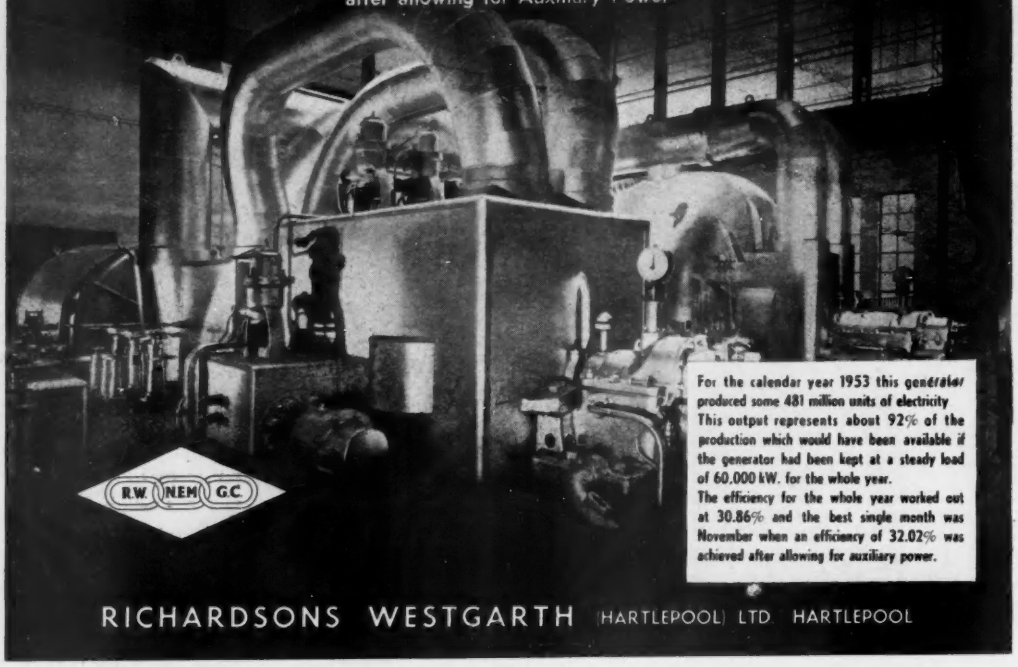

For the calendar year 1953 this generator produced some 481 million units of electricity. This output represents about 92% of the production which would have been available if the generator had been kept at a steady load of 60,000 kW. for the whole year.
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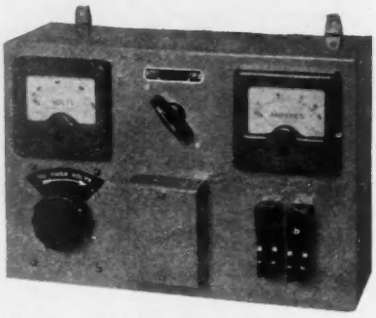

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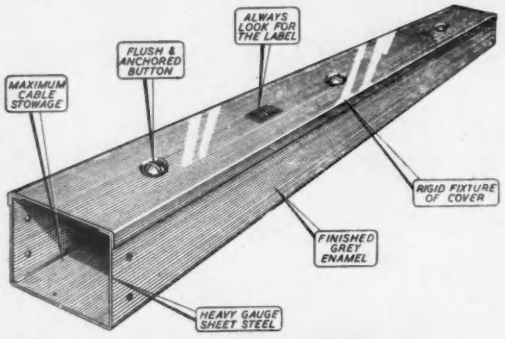

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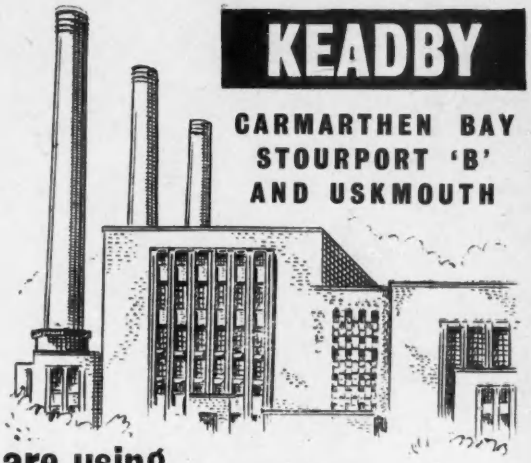

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CARMARTHEN BAY
STOURPORT 'B'
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ALUMINIUM SHEATHED
POWER & WIRING CABLES

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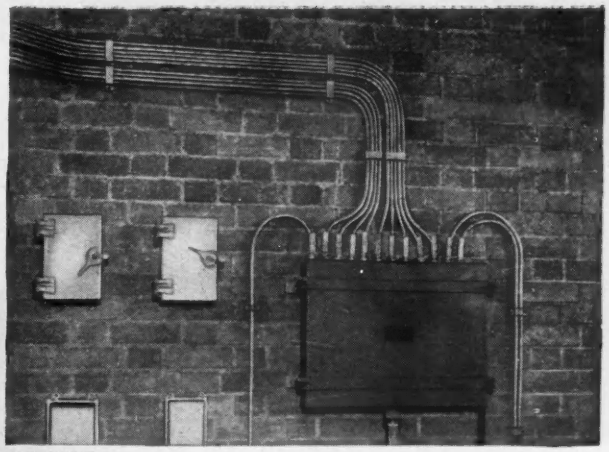

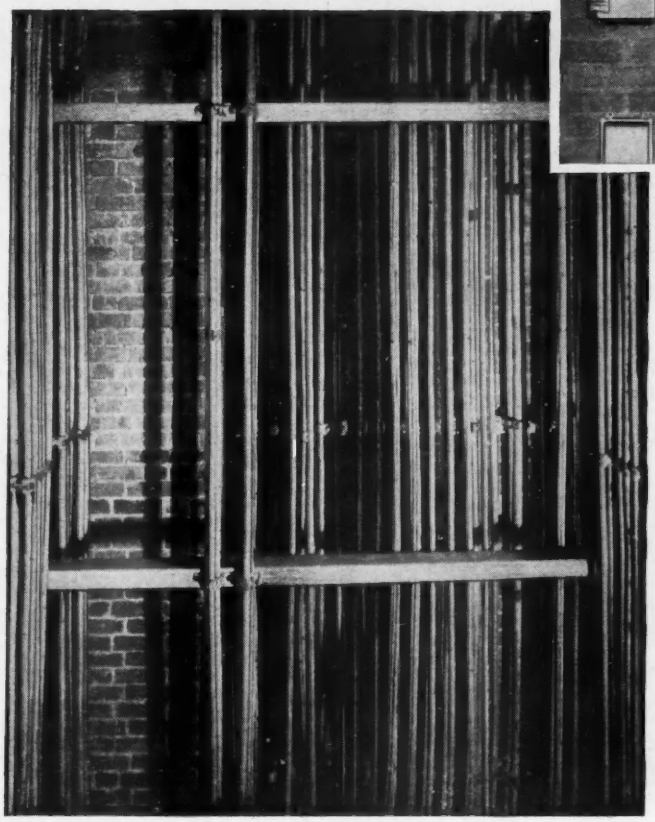

Above: Neatly installed formations of aluminium sheathed wiring cables terminating in a marshalling box.

Left: A main cable trunk at Keadby comprising 150 h.v. and l.v. cables, all but a few being aluminium sheathed.

Keadby is the first of several new power stations in which extensive use has been made of aluminium sheathed cables.

Three of the 60 MW sets are served by J. & P. Aluminium Sheathed Cables, a total of 73 miles of paper insulated and rubber insulated types being involved.

Photographs taken at Keadby Power Station.
Consultants: Messrs. Ewbank & Partners Ltd.
Cables installed by W. T. Henley's Telegraph Co. Ltd.,

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H.R.C. Fuse Links by BRUSH

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31/1

CONDUIT & FITTINGS SUPPLIED BY

METALLIC

A COMPANY

It may be a School, it may be a Factory – a Power Station or a Housing Estate, but more often than not the electrical specification will be – METALLIC.

This Yorkshire building is no exception, being fitted throughout with METALLIC Conduit and Fittings – unequalled for quality and consistent accuracy.

Oswin House, Bradford.
Photo by courtesy of Stroud, Riley & Co., Ltd.

Electrical Contractors:
A. R. Farrar & Co., Ltd., Bradford.

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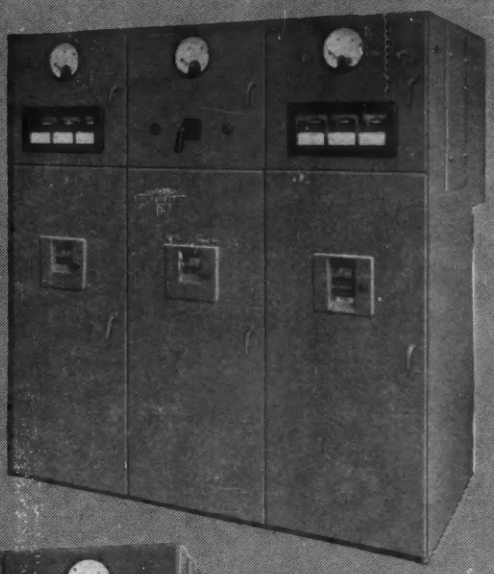
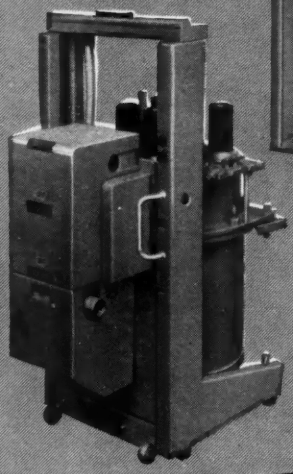
H.V. Metal-Enclosed SWITCHGEAR

150 MVA at 3·3 kV
250 MVA at 6·6 & 11 kV





Type V1H, air-insulated. Type V2H, compound filled. Available for ratings of 400, 800 and 1,200 amps.

Please write for further information.

These three illustrations show the clean design. Cubicle doors open to allow breakers to be pulled forward on their trucks but, in addition, they can be readily removed from their hinges to give full access to the interior without obstructing the space in front of the switchboard.

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

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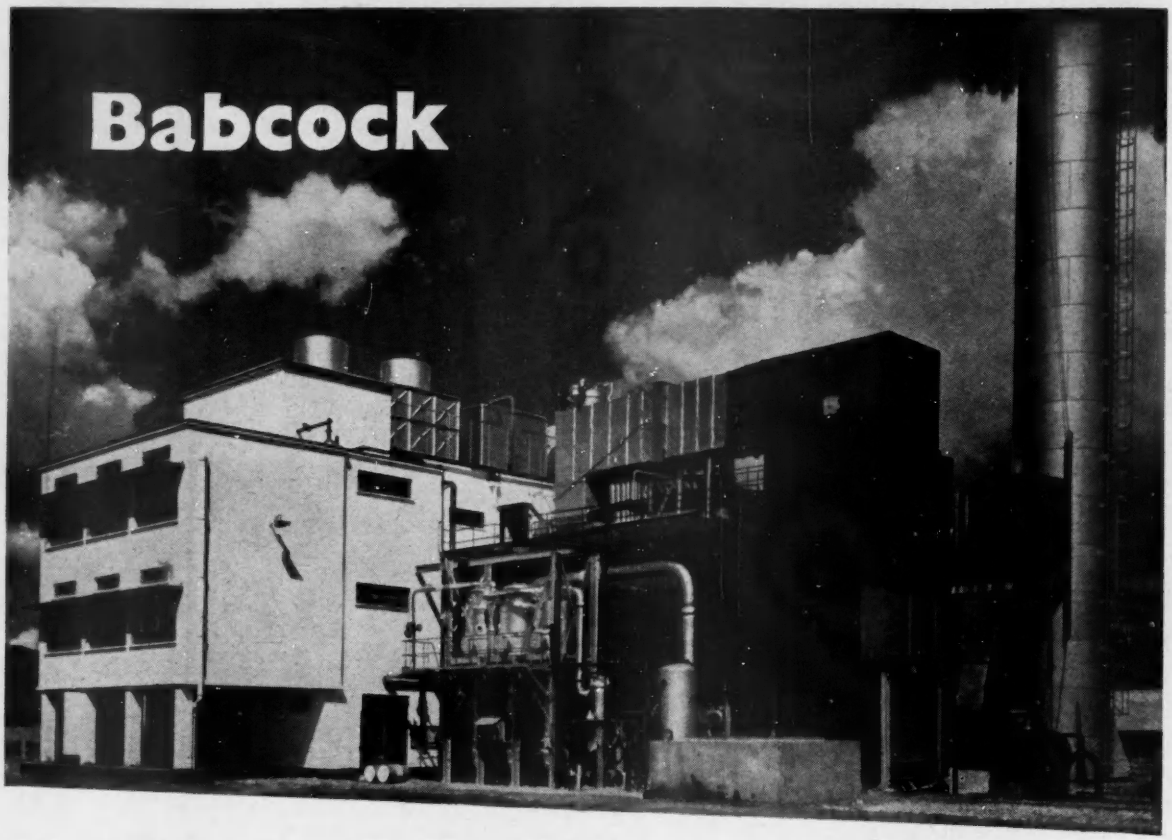
Leading Electrical Progress

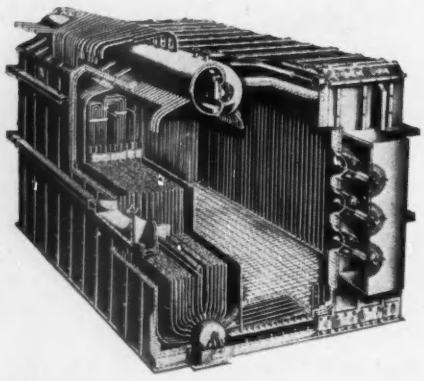
F/A401



"outdoor" boiler installations

Above: *'Outdoor' boiler installation comprising a 130,000 lb./hr. oil-fired Babcock Integral Furnace boiler, at Hunts Bay power station, Jamaica. Consulting Engineers: Ewbank & Partners.*

Below: *Sectional view of an oil-fired Babcock Integral Furnace boiler.*



An interesting development in the design of steam-raising installations for industrial service and also for some electric power stations, particularly overseas, is the use of 'outdoor' boiler installations in which only the firing floor and control points may be under cover and no boiler house structure is involved.

The Babcock Integral Furnace boiler*, compact, self-contained, flexible in operation, with quick-steaming characteristics and high availability, has proved ideal for such applications. It is available in capacities from 40,000 to 250,000 lb. steam/hr., for steam conditions up to 900 lb./sq. in. and 900°F., with oil, gas or coal firing, singly or in combination.

Babcock & Wilcox Ltd. design, manufacture and erect complete installations of this type including steel chimneys, pipework and all auxiliary equipment.

* *Ask for Publication 1525*

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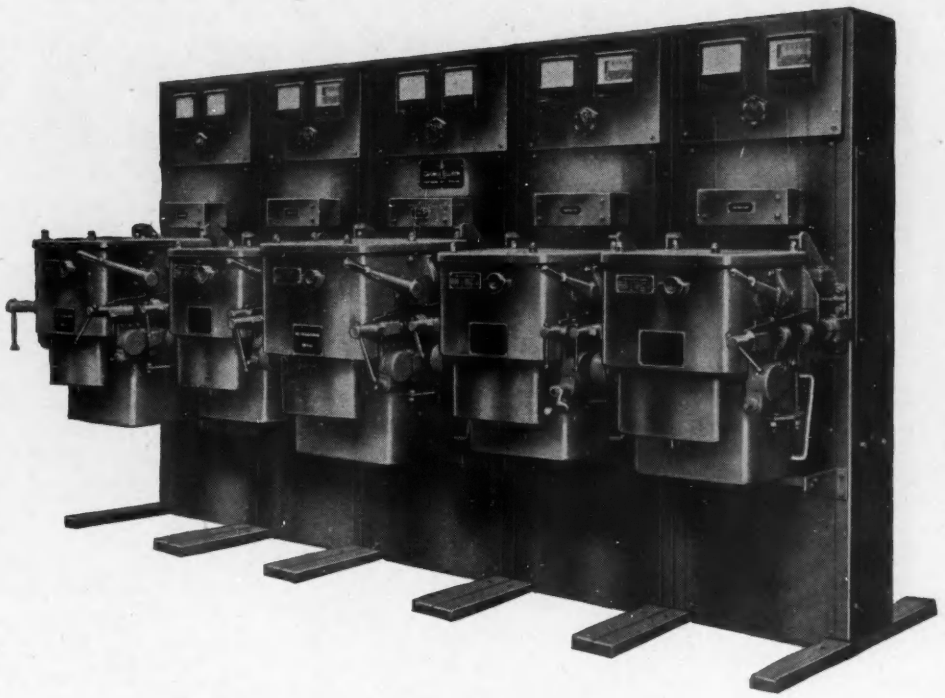

"ELLISON" 660 VOLT DISTRIBUTION SWITCHBOARDS are available with tested circuit breakers in current rating sizes of up to 2400 amps and 45 M.V.A. rated breaking capacity. They are designed for easy and safe maintenance and flush mounted instruments add to the clean appearance.

YOU CAN RELY ON AN ELLISON PRODUCT
Regd. Trade Mark

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727

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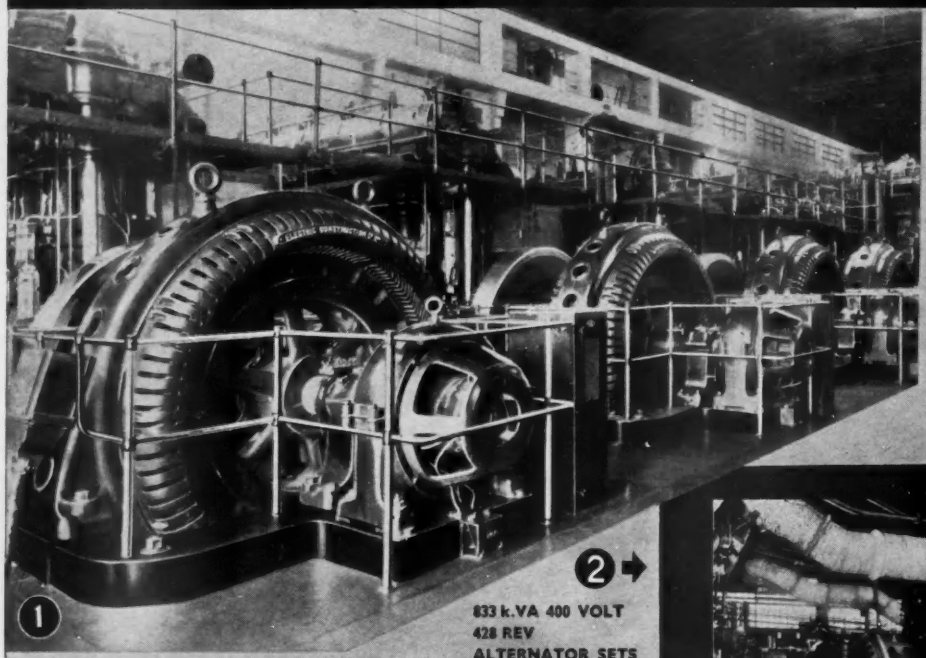

1

6kV DIESEL-ENGINE DRIVEN ALTERNATOR SETS AT THE QUEEN'S ROAD (ST. HELIER) GENERATING STATION OF THE JERSEY ELECTRICITY SUPPLY COMPANY LTD.

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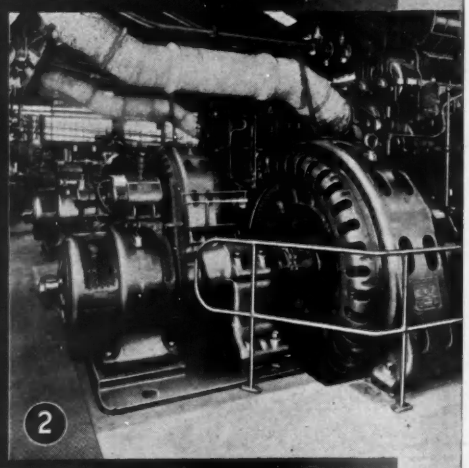
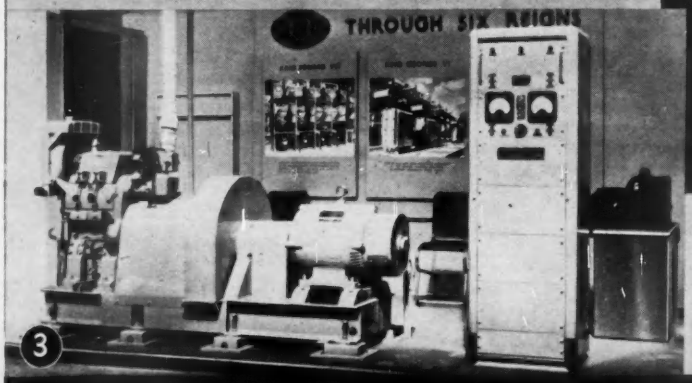


2

Brochure B1720 "ECC ALTERNATORS" Available on request



3

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 30 SEPTEMBER, 1954
Volume No. 126 Number 3282
REGISTERED AS A NEWSPAPER

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2.

Telephone: HOLborn 6016
Telegrams: Equivolt, Estrand

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RECORD SUPPLY SURPLUS

A record financial surplus is not necessarily a yardstick of efficiency for a monopoly but for a nationalised industry subject to perennial cold draughts of public opinion and a major technical reconstruction on its hands, the £13m earned by the B.E.A. last year is a creditable achievement. Although the general increase in costs has been slowed down, it is none the less an ever-present factor which is shown by a rise of only £6m in the surplus over last year, compared with a £14m gain in revenue due to a higher average unit price. It is clear that year after year the B.E.A. succeeds in balancing its accounts to within an unusually narrow margin and the overall return on its capital liabilities including debt service is no more than some 4¾%, a figure that would be considered too low for concerns without such an entrenched commercial position. While the general situation is reasonably satisfactory if the present level of industrial activity is maintained, the individual picture of the area boards is less balanced. This is recognised by the transfer of a quarter-million pounds from the central reserve fund to the South Western Board which has succeeded this year in making a small profit. The position of the Eastern Board is, however, progressively deteriorating while those boards in a strong financial position continue to do well. Such matters will form the subject of a critical review of the Report to be included in next week's ELECTRICAL TIMES.

STEAM AT THE FRONTIER

Even in a relatively crowded island like Great Britain, there are considerable areas of country which can never be supplied economically with electric power from a public network. Among the vast under-developed areas of the world, it is apparent that such limitations must be repeated a thousandfold. In many tropical and near-tropical countries, bullock power is the only reinforcement of manpower in essential agricultural tasks such as irrigation and milling, and hitherto the diesel engine has alone afforded an alternative. In spite of its wide application all over the world in many isolated communities, however, the diesel is often no answer to the problem. Cost of oil rules out its use, and governments are unwilling to base their main industry, agriculture, on a wholly imported fuel. It is in such circumstances that the small and simple steam engine, developed by Sir Harry Ricardo, with the blessing of the National Research Development Corporation, comes into its own. As the description on a later page shows, it makes use of any available low grade local fuel and above that, it is simple to operate

and maintain, and inexpensive to produce. In many uses there will be a direct take-off of power, but its possibilities as a prime-mover for electricity generation are at once apparent. This engine may come to play an important part in the spread of electrification to the backwaters of the world, and it is to be hoped that it will soon come into production on a large scale.

AID FOR WIND POWER

Strangely perhaps, one local "fuel" which the light steam engine may make possible, is wind power. Simple windmills driving generators seem practicable enough, but the intermittent nature of the supply, even on the most favourable sites, makes complete reliance on wind power unwise. Some such arrangement as the installation of a battery to be charged by wind generation is indeed possible, but the cost is generally prohibitive. Much the same criticism applies to the suggestion, promising at first sight, of using the wind-generated electricity to electrolyse water and storing the hydrogen produced for subsequent use. Calculations recently published by the Electrical Research Association show that this process cannot compete with diesel generation on a cost basis. On the other hand, use of small easily started steam engine-driven generators when the wind is too low, might well give a far more encouraging cost picture for a firm supply wind based system. Indeed, such an arrangement would use the wind-power to the best advantage; and the lowered fuel requirements might make operation of the steam engine less burdensome to an isolated community. To give full success, perhaps somewhat larger windmills than are now generally available would be required: there would be a demand for machines with a rating of a few tens of kilowatts. But that is another problem which is also receiving attention from development engineers.

NEW HIGH FOR COPPER

It is now little more than a year since dealing in copper was freed from official restrictions. Then a sharp drop in price was expected, and one even steeper in fact occurred. An early halt was called, however, and the price settled down at a level of about £230 per ton, and since January last this has remained the centre price, with excursions of about £10 per ton on either side. Labour difficulties and fuel shortages in the major producing areas of the world have prevented any renewed fall in prices, even though stockpiling and defence demand have relaxed to some extent. During the present month the market has shown just how sensitive it is to any threat of a serious interruption in supplies. Renewed strike trouble in Chile has sent the price rocketing by some £30 per ton during the month: gains of as much as £19 in a single week have been recorded for cash copper. Were such a rise permanent, it would be serious indeed for our electrical manufacturing industry, with its heavy demand for copper, and for the cable makers in particular. However, consideration of the problem suggests that the high prices will be no more than temporary; already there are reports that the strike which led to them is effectively finished. This interpretation is evidently shared by dealers in copper, for the price for three-months deliveries has increased only slightly in comparison with the rapid rise that has so startlingly characterised cash dealings in recent weeks.

NEW JOBS FOR OLD

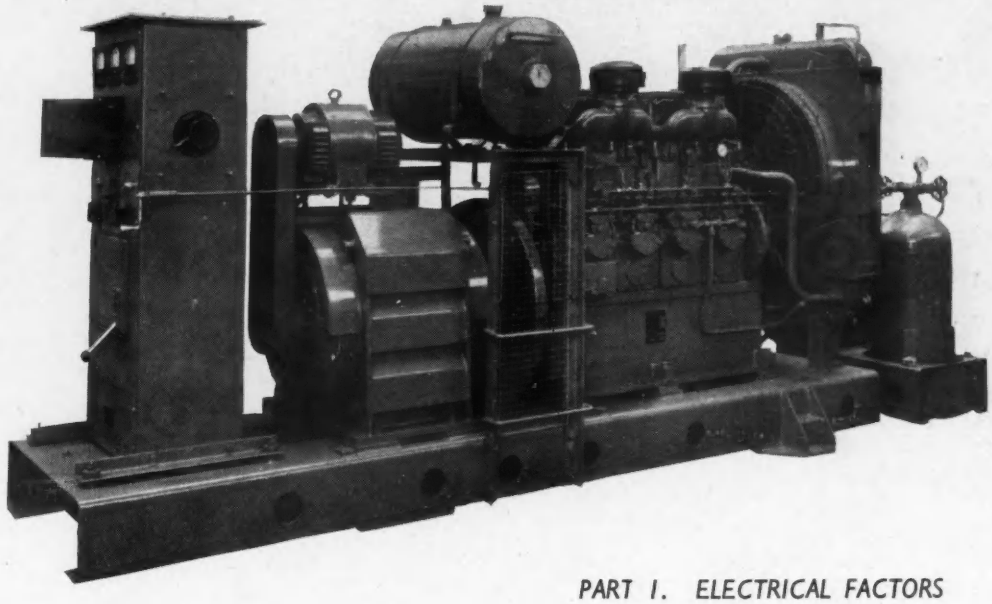
Too old at forty is a phrase that is declining in application with a more stable working community. Now increasing longevity is giving us "too young at sixty." The operation of compulsory retirement combined with the lengthening span of life is creating a cadre of men, who, retaining sufficient virility for work, have difficulty in finding an outlet for the use of their accumulated knowledge. As the problem has become increasingly recognised, there have been many attacks on it, and some limited success has been achieved, noticeably by the Ministry of Labour's Committee which is working on the subject. Yet inevitably, work on such a large scale is only of secondary value when professional men possessing specialised skills are concerned, used as they are to fending for themselves. Self-help and its associated self-respect are evidently the qualities behind the formation of the Association of Retired Industrial Executives, which was the subject of a letter in our correspondence columns last week. While gainful employment is a prime object of the Association, useful application of time that may hang heavily and the preservation of accumulated technological experience are other aims it seeks to foster. Certainly the Association is an experiment that deserves success, and a sympathetic consideration from the firms in industry to whom it will look for the realisation of its plans.

PREPARED FOR THE WORST

Electricity on the farm becomes an essential service when appliances such as incubators and brooders are installed. Inevitably, however, perfect supply continuity cannot be guaranteed. Apart from pre-planned maintenance shut-downs, surprise interruptions must be expected due both to the operation of automatic protective gear, and to the need for emergency repairs occasioned by storm damage and similar unpredictable causes. All that can be done in such cases is to tell the farmer what has happened, or is about to happen, so that he can take precautionary action: and in this respect the introduction of a standing arrangement for emergency telephone messages from control centre to consumer is a useful step in creating good consumer relations. A scheme which the Southern Electricity Board circulated to its Consultative Council last week can probably be matched by similar plans from other boards, but it shows the essentials of what is required. All that is possible will be done to help the consumer for whom electricity supply continuity is vital: though he must be prepared to help himself when he has prior knowledge of a failure. Willingness to advise and to co-operate are at the basis of the scheme and its successful operation can hardly fail to leave consumers at least mollified, and, on many occasions saved from costly damage.

Meteor

Choosing Diesel Plant for Overseas



Top : 55 kW diesel-alternator set (McLaren) showing governor control brought to switchboard for convenience in synchronising

PART I. ELECTRICAL FACTORS AND INSTALLATION DETAILS

By J. MELLANBY, M.A., A.M.I.E.E., M.Inst.F.

THE diesel generator is such a versatile piece of equipment, able to perform many duties, that the drawing up of electrical specification for each case is a matter of considerable importance, even though occasions may arise where there is a conflict between standardisation and performance.

When a generator is required either as an emergency stand-by in case of mains failure, or to be run in conjunction with a public supply to give relief at peak load, its electrical details must obviously conform to those of the supply undertaking. Where it operates in isolation there is great latitude in the type of current to be generated. In the past such plants, especially when required for lighting were often d.c. with batteries, which gave added reliability in the days of relatively costly and temperamental engines, and allowed the supply to be maintained under conditions of very light load. Today the position is vastly different. A battery costs at least four times as much as the diesel generator which can charge it at the normal 10-hour rate, has a higher rate of depreciation and requires skilled maintenance, while engines can now be started at a moment's notice either automatically or by relatively unskilled attendants. Further, the use of a.c. at standard voltage and frequency permits the employment of all the normal motors and appliances, except, perhaps, synchronous clocks on the smallest plants. While single-phase alternators are normally used on the smallest plants, the use of three-phase shows distinct advantages at about 10 kW and upwards in the reduced size of generators and their greater efficiency. Some clients question this and refer to the alleged danger of phase-to-phase voltage and the inconvenience of balancing a lighting installation. These arguments are not really valid, however. Three-phase wiring can show a useful saving in main conductors and control gear and there need be no danger if the regulations are complied with and the workmanship sound. (See description of wiring in Laundry in "Electricity comes to Aiyetoro," ELECTRICAL TIMES 24th Sept., 1953.)

There are many most ingenious arrangements which will start up the plant at predetermined times or in the event of mains failure, reduced voltage, etc., synchronise automatically, put on load and close down when no longer required. In some instances the control gear is bulkier and almost as costly as the set itself. Special care should always be exercised when purchasing such equipment, and the question continually asked: "Is this or that gadget really necessary?" Automatic alarms which will call the attendant when things go wrong, however, are relatively simple and have much to recommend them, provided their installation is not overdone, and they are not ignored through too frequent calls of "Wolf, wolf."

Types of Alternators

Since we are primarily concerned with alternator sets, some consideration must be given to the various types of machine and means of voltage regulation. Alternators may have rotating fields and stationary armatures or vice versa, and may be either self-regulating or require a separate automatic regulator to maintain a constant voltage. In the smallest sizes, in which one machine combines the functions of both alternator and exciter, the rotating armature is commonly used. A disadvantage is that the entire current must pass through the slip rings and brushes, and these may be troublesome under severe climatic conditions. These machines as made today are usually self-regulating, and maintain a constant voltage with change of output current provided the power factor of the load is 0·8 or over. On low power factors the regulation is much less close, but as these small machines are nearly always single-phase and used to supply predominantly lighting loads, this fact is of little importance, and their

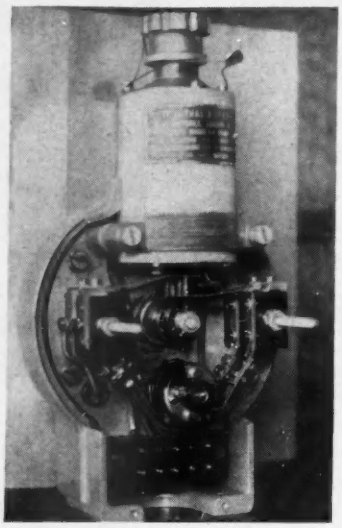


Fig. 1. Vibrating contact type of automatic voltage regulator (Isenthal)

performance in practice is quite satisfactory (Brush and B.T.H. types.) There is, however, one machine of this type, which, with the aid of an additional winding and an extension to the stator, provides complete compensation at all power factors, though it is somewhat more costly than the simpler types giving only partial compensation (Mawdsley).

Alternators working in conjunction with separate regulators may be either rotating armature or rotating field. The latter require separate d.c. exciters to provide the field current, while the former may either have separate exciters or use an extra d.c. winding on the armature. The rotating field type has some advantages over the rotating armature, especially where maintenance under difficult overseas conditions must be considered. Many of the rotating armature alternators turned out during the years of "short supply" were actually conversions from old d.c. generators, in which the armature was rewound and the commutator removed.

Voltage Regulators

The regulator with the longest history is the carbon pile, which was first used about 1880. Its principle is simple; the resistance of a column of carbon discs varies with the applied pressure. The column is inserted in series with the field, and the pressure is controlled by a solenoid operated by the output voltage. It is a fairly simple and cheap device which gives a really constant voltage, but it has the disadvantage that the carbon discs gradually disintegrate, especially in tropical climates and under vibration. Modern design has greatly reduced the size of this apparatus, but at the expense of reliability under difficult conditions.

The vibrating contact regulator is also very much used. Only one manufacturer's type will be described here, as they all operate on the same principle. Two pairs of contacts are continuously opened and closed by cams on a shaft which is driven either by a belt from the engine, or by a small motor. At the same time the height of the "fixed" contact is controlled by a solenoid connected via a rectifier and transformer to the output circuit of the machine. Resistances in series with the field are short circuited as the contacts vibrate. If the voltage rises, the change in the height of the "fixed" contact keeps the resistance in circuit for a longer proportion of the cycle, and conversely for a shorter proportion if the voltage falls. The actual line voltage is therefore not really steady, but oscillates about its mean value at a speed which is independent of the supply frequency. This does not matter for all ordinary purposes, and the regulators give excellent service if the contacts receive a small amount of attention. There is, however, one disadvantage. If the current should fail in the control solenoid for any reason, this will drop to its limiting position, and the device will "think" that the line voltage is low, and so cut out the field resistance for the whole cycle, thus actually raising the voltage to the maximum possible value, which, with a 230 V machine on light load may be well over 300 V. This is, of course, dangerous and the makers state that in order to avoid it, no switch or fuses should be inserted in the transformer circuit. Even when this is done the arrangement is not foolproof as the following experience shows:

Two alternators were running in parallel when the regulator transformer of one broke down, putting one phase to earth through part of its primary winding, a resistance which was too high to blow the 60 amp main fuse. Although the neutral was earthed, the plant was on laterite soil in Africa where the earth resistance during the dry season could be as high as 300 ohms. The switchboard

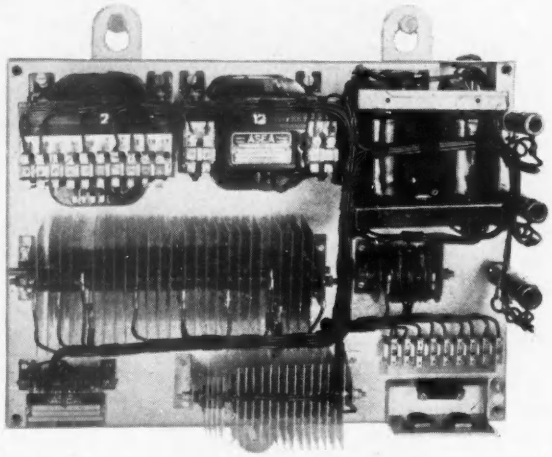


Fig. 2. Transductor regulator for 53 kVA generator with 1·8 kW exciter (ASEA). The transductor itself is seen top right

and the conduit system in the adjoining workshop were, therefore, made alive, and shocks were obtained by the workers from the machine tools. Fortunately none of these was serious. Although the control circuit broke there was no excessive rise of voltage which might have drawn the attention of the attendant to the fault. The voltage was kept steady by the regulator of the paralleled alternator.

Apart from any consideration of earthing, this trouble could have been avoided by a fuse in the transformer circuit, and by making this 15 amp (the transformer takes less than 1 amp) there would be little danger of its breaking fortuitously. The transformer earth fault which was of too high a resistance to cause the 60 amp fuse to blow would not have had this effect on a 15 amp fuse.

Another form of regulator, known as the "Transductor Regulator" makes use of a transductor or magnetic amplifier, to control the field current of the exciter. The transductor consists of an iron-cored reactor, normally split into two separate units each with main and control windings. A direct current, derived from the generator output through a rectifier traverses the control winding. The main windings form part of a circuit, also fed with a.c. from

the generator busbars which includes a resistance, common to this and to the exciter field circuit, and a second rectifier. A drop in the output voltage lowers the current in the control winding, reduces the saturation and thus the impedance of the transductor, and so increases the current in the main winding, which, when rectified augments the exciter field.

By a suitable design in which the circuit components are properly proportioned to each other, a practically instantaneous effect may be obtained from the regulator, whose main advantage is the absence of moving parts.

This type of regulator has been extensively used in Sweden, more especially for diesel sets and emergency power plants. It is manufactured in three standard sizes, the largest of which is suitable for 3,000 kVA 3,000 r.p.m. turbo-generators.

Finally, the "Magnicon" system, more recently introduced, is particularly interesting. Though usually classed among the self-regulating alternators, its principle of operation is rather different. A rotating field alternator is used in conjunction with a "Magnicon" exciter. This is a d.c. generator which also acts as a rotating amplifier, its output being controlled by the line voltage of the alternator which is applied to its field through a transformer and rectifier. The exciter, therefore, combines the functions of exciter and regulator. This system uses fewer additional components than the others and gives complete compensation at all power factors.

Switchboard Design

Switchboard design is a matter of great importance if the plant is to perform its duties properly, and attention is to be simple. Switchboard instruments should be easily visible from all parts of the station; meters of less than 6 in. do not satisfy this condition. Each set should have (if 3-phase) three ammeters and a voltmeter. The use of a single ammeter and a switching arrangement with current transformers is a doubtful economy; the switches give trouble in tropical climates, and the facility which separate meters give of tracing overloads when supplying lighting circuits, and of checking undue circulating current when running in parallel is valuable. There is very little use in a voltmeter switch with which the voltage of all phases can be measured. If the meter is permanently connected to one phase it is usually quite sufficient. A kWh meter is useful if it is required to keep accurate accounts of the running of the station. Many sets made for the Services during the last war were fitted with hour meters (counters calibrated to read hours at nominal rated speed); this was most valuable and helped to ensure that maintenance was carried out at the proper times. It is a pity that these meters were omitted, presumably from motives of economy, from sets for civilian use.

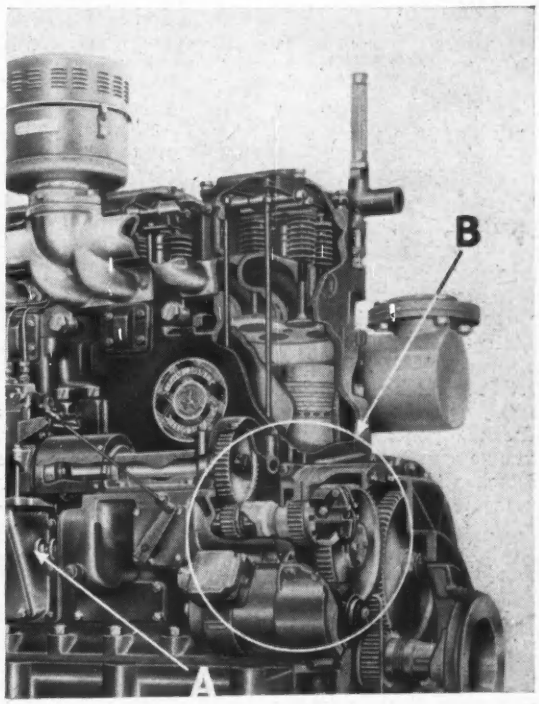
The usual swinging synchronising panel is a convenient arrangement, and should include incoming and busbar voltmeters, frequency meter and switch and synchroscope. Although synchronising can be carried out perfectly well with lamps, the synchroscope with pointer and flashing-coloured lamps makes the job easier, and is a great help with relatively unskilled attendants.

The governor is, however, a most important device when parallel running is required—not only should it give a close control of speed without hunting, but adjustment should be simple and smooth for use when synchronising. Unfortunately the arrangements on many small sets are far from ideal, but some work very well (see Fig. 3). It is normal practice to include compensating devices in the regulator circuits operated by current transformers on the output to reduce circulating currents during parallel operation, by effecting the accurate matching of voltage of the different machines. It is doubtful if these devices are worth while on the smaller plants, they can only operate if the speed is accurately fixed, as although all the generators feeding into a set of busbars are necessarily giving the same frequency, the performance of the compensator is not necessarily independent of this, and although accurate load sharing is theoretically possible with identical sets, if they are different many complications arise, especially with a varying load. In actual fact practical operation is not so difficult as consideration of all the possible variables might lead one to believe, and, with an installation of four sets comprising three different types and sizes, of which every possible combination was at one time in use, it was found most convenient to use the automatic regulator (in this case vibrating contact, Isenthal) on one set only, the others trailing along in the hand control position—load sharing was then done roughly with the field rheostats and finally by adjusting the throttles. While the connected load was varying the attendant was kept fairly busy, but he quickly learned the settings for most normal conditions, and though circulating current was not eliminated altogether, it gave little trouble. This switchboard was fully instrumented, and circulating current could be checked easily by comparing the sum of the generator meters with the total outgoing current. The use of 4-pin plugs and sockets for synchronising is preferable to the multi-position rotary switch sometimes fitted to small plants; the notice of the attendant is drawn to the correct panel and this helps to eliminate mistakes.

Control and Protection

There is a divergence of opinion as to the best type of control and protection gear for small alternators, especially when parallel running is required. The circuit-breaker has much to recommend it—if a bad shot is made when syn-

Fig. 3. Section of 85 h.p. diesel (McLaren) showing governor mechanism (B) and knurled knob for adjusting speed by hand (A)



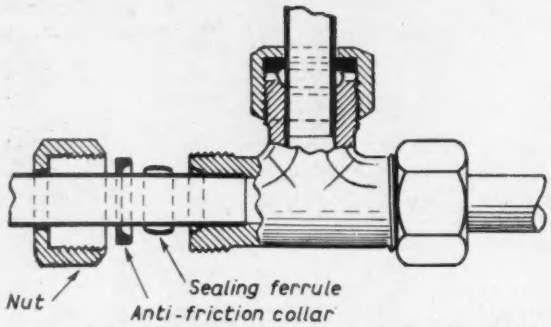


Fig. 4. Construction of compression joint (Simpilfix Couplings Ltd.)

chronising it comes straight out, and no fuse replacements are necessary, but for small sizes it is usually considered too costly. H.R.C. fuses are safe and convenient, but not really necessary in view of the small power involved, and if unskilled attendants are going to make a habit of careless synchronising the cost and difficulty of obtaining replacement cartridges in remote areas may be considerable. Good quality rewirable fuses, working well inside their rated capacity have been found satisfactory. A safety margin is important in view of the high ambient temperatures often prevailing in power stations. Thought should be given to the switch mechanism, and its position on the board. Some switches are very stiff and the action is rough, making closure at the exact moment of synchronism difficult—these may be all right for main switches in buildings which are only operated once a year or so, but something better is required when split second closing may be needed several times a day.

Switchboard lighting is a subject which is frequently forgotten. It has been found convenient to take this straight from the generator terminals and not from the busbars. In the event of trouble on outgoing circuits the station is then not in complete darkness.

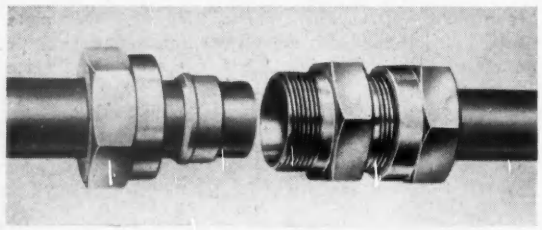
There is infinite variety in the design and construction of switchboards, a sheet metal enclosure being most common, though open type boards still persist for d.c. When operating in high ambient temperatures, heating can become a problem if items like rheostats and rectifiers which normally dissipate heat are boxed up with instruments and connections which do not. When provision is made for ventilation, trespassers may enter. Every engineer must have heard the story of the dog which mistook a busbar for a lamp post, but smaller creatures are even more troublesome. Lizards are apparently excellent insulators and can remain indefinitely across 400 V, but they are dirty creatures as are numerous insects and spiders which make their nests in odd corners. Textile insulation attracts a mould or fungus in damp climates, and t.b. and c.v.r.i. cables should be avoided both for wiring carried out in the makers' works and for power station installation. P.V.C. seems very suitable, and the large range of colours available is a great help in connecting and tracing circuits. The new polythene insulated and p.v.c. sheathed cables may be even better, and ordinary t.r.s. gives good service. Switchboards are relatively expensive at present, largely owing to the labour involved in their manufacture. A measure of standardisation and prefabrication, perhaps using the wiring methods developed for use in aircraft, should effect economies.

Installation Details

Though most of the following points have arisen in connection with plant exported to Africa, it is thought that they may be considered of general interest and found applicable to sets intended for other destinations as well.

The installation of cables between generator and switchboard, usually below the floor is not always the simple straightforward matter it appears. Conduit laid as in "inverted syphon" may collect moisture which cannot get away. In some countries conduit is not used and water pipe may be substituted, but this material is often rough inside and cables may be damaged in drawing in. Sixty years ago, before the advent of electric conduit, "gas barrel" was sometimes used for wiring, and the careful electrician smoothed the interior with a length of chain he kept for that purpose, but this is unlikely to be found in a modern tool box. A common method is to form a trench in concrete, cover it with a board and lay t.r.s. or similar cable in it. This is not satisfactory, spilled liquids and dirt finds their way into the trench, which may also become a home for vermin. A simple and satisfactory method is to form a tube in the concrete itself by the use of inflatable pneumatic tubing (Ductube); this material has many applications and need only be a light and inexpensive addition to the erectors kit. Concrete is seldom completely impervious, and if moisture is thought likely to enter the cable channel, it can also escape by the same route. For protection of the ends flexible conduit may be used—an adaptor is only needed at one end, where it screws into the generator or switchboard, at the other it can be grouted straight into the floor where the channel emerges. When flexible tubing and adaptors are despatched with a plant, the manufacturer should make sure that they fit into each other. There is apparently no British Standard for this material, and although made in a series of nominal bores corresponding to conduit sizes, each maker uses a pitch of spiral to suit his own convenience, so that in general tube from one source will not fit adaptors from another. It is most disconcerting to discover this fact in Darkest Africa, and particularly annoying when it keeps on occurring with different firms.

If cable lugs are needed to make connections, they should be provided with the plant. Occasions have arisen where it has been necessary to sacrifice a few feet of copper fuel pipe and make lugs on the job. Terminals should be properly marked—some makers fit a permanent engraved brass plate inside the junction box cover which is an excel-



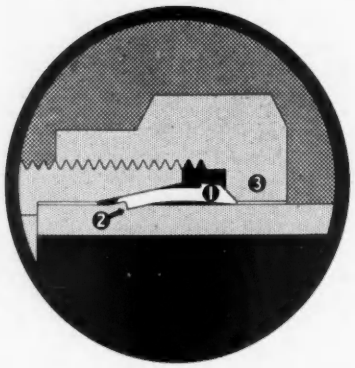


Fig. 6. High Pressure Pipe Coupling (British Ermeto Corporation Ltd.) The sectioned view on the right illustrates the action of the joint. 1 is a case hardened ring, in which a sealing flange 2 is cut as the locking nut 3 is tightened

lent idea; others merely punch letters on the lugs—this merely causes confusion when the lugs are removed for soldering. It has actually been said that a competent electrician should be capable of working out the connections himself without any of these aids. This, of course, is true, but the said competent man is presumably paid to do the job and not to spend time in solving puzzles. While properly soldered lugs are probably one of the best ways of dealing with the larger main conductors, they are not necessary with small pilot or control wires, for which there are a number of excellent solderless connectors available, such as variations of dished washers or the crimped terminals now commonly employed in aircraft work. Yellow empire tape deteriorates rapidly in a tropical climate, and apparently forms an attractive diet to some insects, but the black type of this material appears not to suffer from these disadvantages.

Piping

The piping for even a moderate set may easily involve a lot of work, especially if heat recovery or other auxiliary equipment is included. As much as possible should be prefabricated in the manufacturers' works, but a considerable amount of site work is inevitable. Where steel piping is used, this material can usually be purchased locally in any part of the world, but all the fittings should always be provided with the plant. It should also be remembered that while British and European standards are interchangeable, there are most annoying differences with American material, in some instances the difference is only $\frac{1}{2}$ t.p.i., but that, combined with the American thread angle of 60° and the British one of 55° is enough to cause leaking joints. The biggest difference occurs in the $2\frac{1}{2}$ in. size, which is commonly used for exhaust pipes, where the pitches are 8 and 11 t.p.i. and the o.d. of the American article is about $\frac{1}{8}$ in. less than that of the British.

Fuel, lubricating oil and similar piping is usually of copper or solid drawn steel joined by union connectors. Most makers adhere to the original type in which a nipple is soldered or brazed to the pipe. This arrangement is perfectly satisfactory when fitted in the factory, but can be troublesome when much site work is required. Suppose, for example that a fuel pipe is made up with nipples brazed on to each end, and it is found necessary to shorten it. If a spare is available the job is a simple matter of soldering, if, as is often the case, there is no spare, the removal, with the tools normally available during erection, of $\frac{1}{2}$ in. of pipe and some brazing metal can waste a surprising amount of time. The more general use of the compression type of coupling would save a lot of trouble and still provide a joint which can be broken and remade repeatedly. There is one type of coupling which will withstand the highest pressures and which has proved invaluable when carrying out repairs to fuel injection lines, and a number of others give excellent service for lubricating oil and on the suction side of the injector pump.

Foundation bolts are another item about which there would appear to be little to say, and makers' drawings are often marked "Bolts to suit foundation depth as settled on site". Overseas the only material available is often reinforcing rod which has neither the strength nor the fatigue resistance to stand up to the required conditions, and the digging out of broken bolts is an annoying job which occurs too frequently as part of maintenance. Manufacturers should supply the longest bolts which are likely to be necessary, it is a small matter if they have to be cut and rethreaded on site, but it is then possible to guarantee a material which will be suitable for the conditions imposed.

Earthing has already been mentioned as giving difficulty on some soils. In most instances a series of vertical rods driven into the ground provide as good an earth as can be obtained. These rods are usually $\frac{3}{4}$ in. diameter h.d. copper supplied in 4 ft lengths joined together by 5/16 in. B.S.F. studs. It is suggested that these rods could be improved by increasing the size of the studs to 7/16 in. which would greatly improve the mechanical strength. Connection at the top is usually by a heavy and clumsy clamp, but just as good contact can be obtained with a cable lug and a nut, especially if the larger size of stud is fitted. In areas where lighting may be troublesome, the non-linear type of arrestor gives excellent protection. When a generator is supplying an overhead distribution system, the top of the first pole is the best place for the arrestors.

(To be concluded)

Wind-Power Developments in Denmark

TECHNICAL developments in the field of wind power utilisation have been continuous in Denmark since the setting up of a testing station at Askov in 1891. Something of the success achieved is related by E. W. Golding and A. H. Stodhart in a newly-published E.R.A. report (C/T112), "The Use of Wind Power in Denmark." While the first Askov mill had a 75 ft diameter rotor and developed only 18 kW, the most recent d.c. machine of the same size is capable of over 70 kW.

In the ten years before 1939, when the cost of imported fuels was low, there was relatively little call for wind-generated electricity. During the war, however, d.c. wind power stations increased in number from 16 to 88. In 1944 they produced 3m kWh. They were used chiefly in conjunction with small village power stations.

Post-war development by the South-East Zealand Electricity Supply Co. (SEAS) has led to the development of a 45 kW wind-driven generator running in parallel with an a.c. network. It has a 43 ft diameter three-bladed fixed pitch rotor running with a blade-tip speed of 125 ft/sec. The blades are braced with streamlined struts, and have tips of variable angle which can be turned up to 45° from the plane of rotation. It is thought that given a suitable gear box, the machine could give an output greater than 45 kW; indeed, there will probably be no serious problems in scaling up the design to 100 kW or even more. It seems likely that such proven machines could be constructed at low cost in large numbers, so there is no logical reason to experiment with larger sets. It is suggested by the authors of the report that the production of electricity by wind power for feeding into an a.c. network will be developed on a significant scale in the fairly near future.

Hydrogen Storage

Another newly-published report (C/T111), this time by Mr A. H. Stodhart alone, discusses the economic value of hydrogen produced by wind power. The basic idea is that hydrogen can be produced by electrolysis and then used either to provide light and heat directly, or as fuel for an internal combustion engine: this may present advantages over the alternative of importing oil.

The conclusion reached is that as a means of supplying heating and lighting to an isolated community a windmill-hydrogen plant is, even under the most favourable conditions, twice as costly as paraffin. Compared with a diesel-generator, it is still over 50% more costly. Thus it seems that the only possibility of application of the hydrogen idea is in isolated observatories, base camps of polar expeditions, etc., where economic considerations are of secondary importance. Even here, it may prove impracticable for other reasons.

Steam in Miniature

LIGHT STEAM ENGINE POWERS ISOLATED SITES

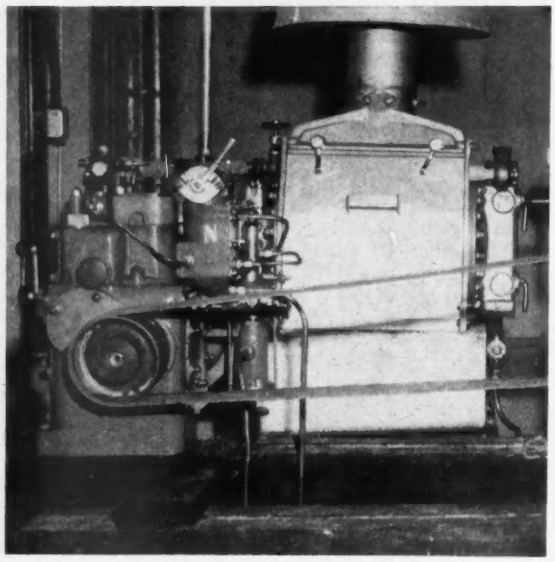
SMALL prime movers are in demand in the so-called under-developed parts of the world. In many places, bullock power is the only readily available substitute for man-power. Diesel engines are an obvious answer to the problem, but they introduce difficulties in terms of fuel supply, cost being outstanding amongst these.

It was considerations of this sort that led Sir Harry Ricardo, the well-known designer of internal combustion engines, to give attention to the design of a light steam engine, capable of being operated off simple boiler plant fired with low grade fuel. It was felt that much of the engineering progress which had taken place in the light i.c. engine over recent years could be applied successfully to light steam engines. The project of designing such a steam engine was sponsored by the National Research Development Corporation, and the results were demonstrated to the Press and to prospective manufacturers last week.

The prime mover developed consists of three units which can be transported separately and assembled where required. The units are the furnace, the steam generator and the engine.

The Engine

In its present prototype form, the engine is a vertical two-cylinder uniflow design, in which the outstanding feature is the use of cut-off rather than throttling for control, in order to conserve steam. Including flywheel and belt drive, the engine occupies approximately an 18 in. cube. Fed with steam at 150 lb/sq in., the engine develops a continuous output of 2½ b.h.p. at 1,250 r.p.m. Speed, however, is not critical. One of the advantages of the steam engine is that it will not stall; when load is reduced sufficiently, the engine restarts automatically. Moreover, there is a considerable overload capacity, and an output of 3·5 h.p. can be safely obtained for considerable periods intermittently. It is thought that the present design can be scaled up to a 5 h.p. size with little difficulty.



In this experimental rig the engine is to the left and the boiler to the right. The engine is seen from the driving end

In designing the engine, close attention has been paid to simplicity, bearing in mind the unskilled men who are likely to have to operate it. Amongst the special devices provided is one which automatically draws off any condensate which may have got into the crank case. Simplicity has been kept in mind also in choosing the operating pressure of the engine. The temperatures associated with steam input at 150 lb/sq in. are such that almost any kind of lubricating oil may be used, including types commonly available in tropical countries.

Each cylinder of the engine is 2¼ in. bore by 2½ in. stroke, the pistons operating 180° out of phase. Exhaust ports are opened when the piston reaches the bottom of its stroke. With the valve gear provided, the engine is non-reversible. There is one main inlet valve to the valve-chest and an outlet valve to each cylinder. The master patent for the engine covers the arrangement of the valves, whereby the timing of the main inlet valve relative to the others is altered through a link rotating it in a helical slot; the bob-weight governor operates on the link and alters the per cent cut-off. Steam economy by this method is such that the specific steam consumption is only 30 lb/b.h.p.

There is an engine-driven circulating-water pump which feeds water to the steam generator, which consists essentially of a cylindrical drum with deep external ribs, end covers secured by studs and suitable cowling. The drum itself is a light alloy casting of 2½ gallons capacity in which the deep ribs give strength and efficient heat transfer from the hot flue gases which circulate around it. An alloy is used which is non-corrosive under all conditions. Water level is kept constant by a special float device, which in addition to controlling the action of the feed water inlet valve, incorporates a low water-level safety device. A simple superheater is incorporated below the chimney to ensure that the steam received by the engine is dry.

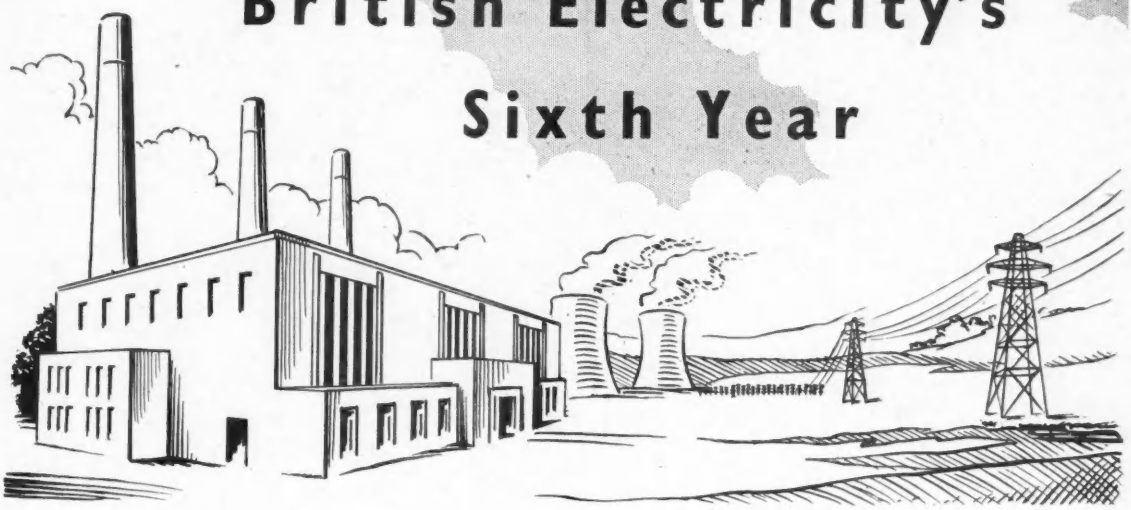
A simple design of furnace has been evolved which will deal with all types of fuel. In practice, a small and compact form of this will be used when the fuel is coal, peat or wood, and a somewhat larger furnace with bigger grate area when such agricultural wastes as sugar-cane trash or cotton stalks have to be burnt.

Applications

Subsequent to the evolution of a practical design, tests of the engine under realistic conditions have been undertaken. In charge of these has been Brigadier M. H. Cox, who has had wide experience in Eastern countries. Addressing correspondents during the demonstration last week he emphasised the need to build up the productivity of the small farmer in eastern countries, but stressed the unwillingness of Governments to do this on a basis of imported fuel.

Amongst the units on view was a medium head pumping plant which had run for 800 hours, for 500 of them driving a centrifugal pump of the type used for irrigation, which was delivering 5,000 gallons water per hour at 30 ft head. On several occasions the engine has run for 24 hours continuously, with only short intervals for blowing down the boiler to remove accumulated solids. Also shown was a tropical bungalow, with the engine driving a charging dynamo for a bank of batteries.

British Electricity's Sixth Year



ILLUSTRATED for the first time with photographs as well as diagrams, the Report and Accounts of the British Electricity Authority for the year ended 31st March, 1954, again follows its now well-established pattern. The report itself is somewhat longer than its predecessor and there are some minor changes in the mass of tables and diagrams which comprise the bulky statistical appendix.

For first time, nuclear generation receives an extended mention in the report. The B.E.A. states its welcome of the opportunity of co-operating in developing a practical scheme for a power station employing a nuclear reactor. It is suggested that there may be a useful contribution to the Grid from such stations within the next decade.

In the pages that follow, a detailed abstract of the Report is presented, covering in order engineering, commercial activities, personnel, administration and finance. The Report covers the activities of both Central Authority and Area Boards, and to some extent both are mentioned in the account given here. However, closer attention will be given to the Area Boards in next week's ELECTRICAL TIMES, when there will also be a study of the principal features of the 1953-54 working, as revealed by the reports.

Engineering . . .

CONSIDERING first the overall picture of the generating plant situation, the Authority owned, at 31st March, 1954, 288 power stations with a total installed capacity of 18,647 MW and a total maximum output capacity with all plant in service of 16,904 MW. Of the installed capacity steam plant showed a record figure of 18,403 MW, of which 10 MW was derived from waste heat plant. Some 71 MW consisted of internal combustion engine plant (including the 15 MW gas turbine at Trafford—which, however, because of its experimental nature is not included in other statistics which are given), and 173 MW was hydro-plant.

During the year, the installed capacity increased by 1,490 MW and the total evaporative capacity by 15,457 klb/hr. This represents 8·8% increase over last year, and 50·3% increase above the total at vesting day. New plant was commissioned at 31 power stations including eight new ones which started operating for the first time during the year. These were Bold A (St. Helens), Carmarthen Bay (Burry Port), Carrington (nr. Manchester), Chadderton (Oldham), Connah's Quay (Flint), Doncaster B, East Yelland (nr. Barnstaple), and Roosecote (Barrow). Of these East Yelland is not counted in the statistics because the generating plant there, although contributing to public supply, consisted of a small diesel set primarily installed for constructional purposes. New sections were added to the Deptford East and Huddersfield stations. Three of the new stations and one of the new sections operate with steam conditions of 900 lb/sq in. the remainder being 600 lb/sq in. Shut down plant included 6,000 kW at Hinkley, 6,000 kW (l.p.) at Lincoln, and two diesel stations, Southend (Leigh) and East Retford of 800 and 400 kW respectively.

The Authority plans to increase generating capacity by over 50% in the six years 1954-59, representing a net addition of some 8,600 MW of output capacity. In all some 9,800 MW will be provided as some 1,200 MW of old plant will be shut down. Revised programmes are shown in Table II. The programmes for 1960 (provisional) and 1961 (tentative) are of the order of 1,900 MW. At the end of March this year, 35 new power stations and 57 extensions of existing stations, with an aggregate installed capacity of 11,106 MW were under construction or planned in the programmes up to 1959. Of these, steam plant accounts for 11,045 MW.

Reduction of generating capacity due to breakdown, overhaul and other causes at the maximum load period

TABLE I.—FIGURES FOR STEAM STATIONS 1953-54.
(Classified by Efficiencies).

Average thermal efficiency for year	Max. output capacity	kWh output	kWh output 1952/53
%	% of total	% of total	% of total
30 and over	1·2	2·6	—
28 to 29·99	9·7	14·1	8·7
26 to 27·99	14·8	18·3	19·4
24 to 25·99	21·3	27·7	24·9
22 to 23·99	13·7	14·4	20·5
20 to 21·99	12·2	11·1	10·6
18 to 19·99	4·9	4·2	6·7
Under 18	22·2	7·6	9·2

TABLE II.—PLANT CAPACITY PROGRAMME

Calendar Year	Plant Capacity Programmed	Capacity of New Generating Plant Installed	Government Limit on New Capacity
	MW s.o.	MW s.o.	MW s.o.
1949		703	—
1950		965	—
1951		1,113	—
1952	—	1,539	—
1953	—	1,413	—
1954	811	—	1,450
1955	1,597	—	1,550
1956	1,835	—	1,550
1957	1,892	—	1,550
1958	1,252	—	1,750
1959	1,759	—	1,950

(Mondays to Fridays) of December and January, showed no significant decrease, being 12·4%. Both overhaul and "other causes," however, were the lowest for some years, breakdown accounting for some 7·5%.

Although the rate of installation in 1952 and 1953 had been by far the highest ever recorded, a discrepancy between demand and capacity of 879 MW was recorded on 2nd February, 1954. Had the December 1953 weather been severe, however, there would have been a probable discrepancy of 2,200 MW compared with a corresponding estimate of 2,400 MW for mid-December 1952.

Planning and Construction

The investigations of the National Coal Board into the coal reserves of the country have indicated that increasingly high chlorine contents will be encountered in the future, and the worst of these are expected from the eastern areas of the East Midlands coalfields from which the N.C.B. propose to supply a growing proportion of the B.E.A.'s fuel. It is hoped that special boiler design will get over deposit troubles due to this cause, but it is unfortunate that the new stations in the East Midlands are those which economic factors dictate the use of the highest steam pressures and temperatures and the largest units.

Following discussions with the British Transport Commissions on the new standard 24½ ton wagons, the Authority has put in hand the installation of suitable handling appliances at all new or reconstructed power stations. It is expected that power station requirements in such wagons will rise to 20m tons in 1960.

Cooling water still provides a major problem, largely due to difficulties arising from the restrictive temperature conditions imposed by river boards. Site selection has also proved difficult, an example being that of High Marnham, east of Tuxford, planned to have an ultimate capacity of five 200 MW sets. In full operation the fuel requirement will be about 3m tons per year.

More generating plant would have been brought into operation in 1953 but for delays in construction caused by lack of materials which were required for the defence programme. This lack has also had some effect on the programme for 1954.

Ten schemes for district heating and industrial steam supply were under investigation during the year, and plans to renew and extend the existing district heating installation at Bloom Street, Manchester, were carried to an advanced stage. It is expected that work will begin toward the latter part of this year. With the maximum development now envisaged steam would be distributed, mainly for space-heating to some forty-five commercial premises and public buildings.

Plant Design

With the overcoming of the post-war shortage of plant, manufacturers and the Authority are being given increasing freedom to apply new technical developments. In the plant programme for 1959, with an aggregate capacity of 1,880 MW there are four 100 MW sets, five 120 MW sets and one 200 MW set. This last machine will operate with an initial pressure of 2,350 lb/sq in. at 1,050° F with reheat to 1,000° F. In connection with these high pressure and high temperature machines, the Authority is supporting research into the development and properties of special steels, and intensive studies have been made of the problems of control and automatic protection for the large units. These problems are acute with reheat machines.

The programme of inspection of the seams of riveted drum boilers was continued during the year and some 200 boilers were examined for caustic cracking. Among the total of 787 boilers so far examined caustic cracking with various degrees of seriousness was present in 76. Work is continuing on the utilisation of ash in brickmaking, ground reclamation and as a partial substitute for cement. Smoke and grit emission still remains a major problem, and research is continuing on the improvement of electrostatic precipitators and on the reduction of sulphur dioxide. It is reiterated by the Authority that the best method of avoiding atmospheric pollution is by the discharge of hot gases from high chimneys. Gas washing could only be justified if an acute national shortage of sulphur required uneconomic recovery as a by-product from the flue gases.

Transmission

At 31st March, the main transmission system of the country comprised 5,155 route-miles of overhead lines and cables, of which 4,537 were overhead lines at 132 kV, 41 were o/h lines at 275 kV, 78 were cables at 132 kV and the remainder were cables or lines at 66 kV or lower. There were 323 Grid substations with a total transformer capacity

TABLE III.—OUTPUT FROM STATIONS, 1953-54, (GROUPED ACCORDING TO DIVISION) AND GRID TRANSMISSION SUMMARY

Generation Division	No. of Stations	Maximum Output Capacity 31.3.54 (MW)	% Increase on 1953	Units generated $\times 10^8$	Units Used in Stations $\times 10^8$	Units Sent out from Stations $\times 10^8$	% Increase on 1953	Works Cost/Unit s.o. pence	Capacities of * main transformers (MVA)			Lines and Cables—route miles		
									at 275 kV	at 132 kV	at 66 kV and lower	at 275 kV	at 132 kV	at 66 kV and lower
London ...	28	3,175	10·6	10,420,507	637,432	9,783,075	4·4	0·6755	—	1,695	1,486	—	74·45	218·73
S. Eastern ...	27	1,195	15·8	4,219,121	275,250	3,943,871	13·7	0·5952	—	1,324	75	—	364·63	32·61
Southern ...	23	610	—	2,426,357	137,160	2,289,197	—5·3	0·6346	—	1,510	50	—	536·85	130·28
S. Western ...	24	651	9·3	2,412,397	149,712	2,262,685	9·7	0·6867	—	1,000	102	—	390·09	32·58
Eastern ...	21	945	8·1	3,415,570	225,716	3,189,854	3·6	0·6538	—	1,900	135	—	508·25	9·58
E. Midlands ...	13	1,160	3·8	4,888,853	271,581	4,617,272	4·7	0·4824	120	1,224	—	22·51	407·59	9·13
Midlands ...	16	1,622	3·3	6,611,952	414,094	6,197,858	—0·3	0·5118	—	2,125	—	—	333·15	—
S. Wales ...	22	878	32·4	4,236,617	287,934	3,948,683	19·7	0·4886	—	915	—	—	215·83	—
M. & N. Wales	22	972	15·7	3,842,012	226,173	3,615,839	25·4	0·5557	—	1,315	—	—	212·44	8·05
Yorkshire ...	22	1,814	6·3	7,957,418	473,159	7,484,259	11·8	0·4609	120	1,580	210	†56·04	293·91	16·67
N. Eastern ...	14	881	6·7	3,927,363	252,393	3,674,970	11·2	0·5075	—	525	55	‡82·00	170·54	39·71
N. Western ...	37	1,985	8·8	7,262,738	413,320	6,849,418	2·3	0·5623	—	2,130	—	—	493·50	1·60
S.E. Scotland...	5	208	—	1,041,839	59,717	982,122	11·3	0·5368	—	450	—	—	223·19	—
S.W. Scotland	14	808	1·8	3,444,616	162,443	3,282,173	4·2	0·5098	—	1,155	—	—	271·12	—

*Excluding generator and interbus transformers. †Including 38·04 miles operating at 132 kV. ‡Operating at 132 kV.

TABLE IV.—STEAM STATIONS. TECHNICAL DETAILS AND GENERATING COSTS

Item	Units	1953–54	1952–53	% Change
Number of stations	No.	212	206	3·0
Maximum output capacity, Mar. 31	MW s.o.	16,674	15,302	8·8
Electricity:				
Generated ...	kWh x 10^6	65,586·842	61,173·789	7·2
Used in stations	kWh x 10^6	3,979·075	3,645·485	9·2
Sent out	kWh x 10^6	61,607·767	57,528·304	7·0
Average load ...	% max. cap.	43·92	44·69	—1·4
Fuel:				
Consumed for generation ...	tons x 10^3	37,191·238	35,232·828	5·7
Average calorific value	B.Th.U./lb.	10,782	10,854	—0·6
Consumed for generation ...	lb./kWh. s.o.	1·352	1·384	—2·3
Heat rate ...	B.Th.U./kWh.s.o.	14,580	15,016	—2·7
Average thermal efficiency ...	%	23·40	22·72	3·1
Pulverised ...	% total fuel	41·86	35·31	16·7
Cost/kWh sent out:				
Fuel, including transport ...	d.	0·4553	0·4387	3·6
Fuel handling, etc.	d.	0·0247	0·0245	0·8
Operation, salaries and wages	d.	0·0358	0·0356	0·6
Oil, water, stores	d.	0·0037	0·0039	5·3
Repairs and Maintenance ...	d.	0·0399	0·0419	—4·8
Total works cost	d.	0·5594	0·5446	2·7
"Generation Employees"/MW of output capacity...	No.	2·20	2·36	—6·7

of 21,201 MVA comprising 240 MVA at 275 kV, 18,848 MVA at 132 kV and 2,113 MVA at 66 kV or less. This represents an increase of 24 substations over the previous year, and a net increase (excluding inter-bus and generator transformers) of 3,162 MVA in transformer capacity. On the transmission system there was a net increase of 473 route miles comprising some 41 miles of 275 kV line and 441 miles of 132 kV line. A decrease of 9 miles of line at 66 kV or less is also recorded.

Some of the major transmission works completed were connections to the main transmission system at six new power stations. To prevent overloading of Scottish Grid lines which would occur under certain conditions when large power transfers are being made between England and Scotland, power flow and voltage regulators were installed at Glenlee in the Glenlee-Tongland 132 kV line. Similar equipment was installed at Potter House in the Dunston-Norton 132 kV line. These regulators are the largest of their kind in the country being rated at 90 MVA, 132 kV.

Progress continued on many sections of the supergrid, and the 120 miles of double circuit line with twin 0·175 sq in. conductors between West Melton and Stella was completed. A detailed report is being prepared on the cable-laying trials of the proposed England-France link.

Switchgear

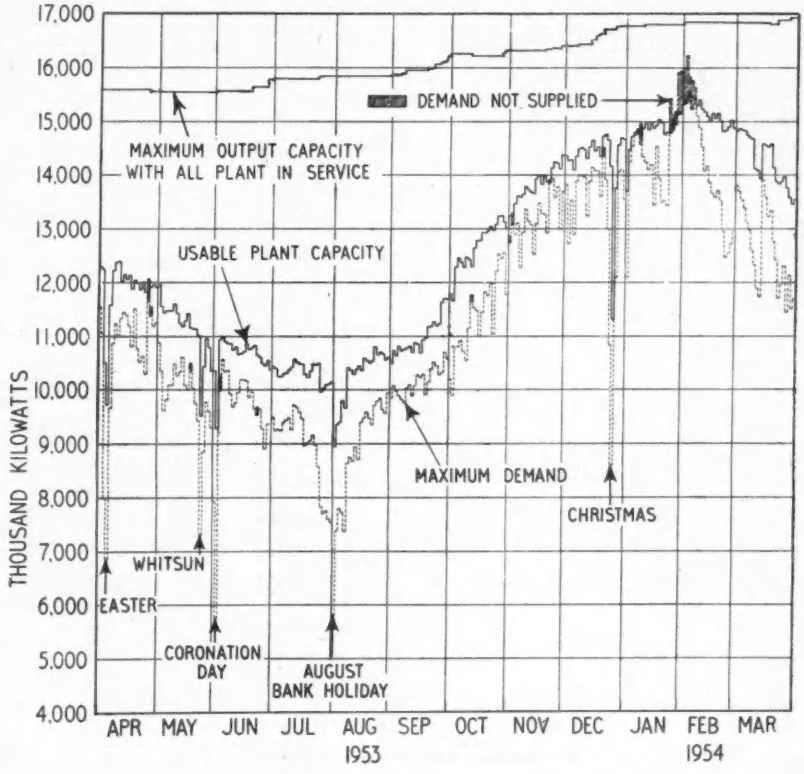
Good progress was made during the year with the detailed design and preliminary testing of 275 kV circuit-breakers, and type tests were made on much of the anciliary equipment for the supergrid. Modernisation of the 132 kV system requires circuit-breakers of higher rating and a further design of of 132 kV bulk-oil circuit-breaker, rated at 3,500 MVA was satisfactorily tested under short-circuit conditions. Many of the existing 132 kV circuit-breakers are being modernised and their rating increased from 1,500 to 2,500 MVA.

Erection of the Authority's first 132 kV single circuit wood pole line from Carmarthen Bay to Haverford West was completed. This is of "unearthed" construction which enables advantage to be taken of the insulation of the wood poles under lightning conditions. During the year there were 468 system faults as compared with 516 in 1952/3 and 86% were correctly cleared as compared with 90·4% in the previous year.

Engineering.—Set size of 200 MW now programmed for 1959.... Thermal efficiency over 30% for new plant, 23·4% average figure.... 275 kV system progressing... Operation greatly eased by Grid reinforcement and improved generating capacity . . . Problems of increasing chlorine content coal may mean expensive boilers.

Research

Some brief details of research projects are included in the Report. In the field, continued investigation was made into the causes and alleviation of boiler fouling and corrosion, and further studies were made of the circulating water discharges from power stations. The experimental gas turbine generator at Trafford Park is still undergoing a series of experimental trials. Work has also been done to verify



in the field the measurements carried out at Leatherhead on 275 kV lines. A wide range of studies of metallic corrosion and methods of preserving plant have been carried out with particular attention to internal corrosion of boilers under conditions of high temperature and pressure.

Operation and Generation

Load reductions, which had to be made to avoid the overloading of transmission lines were considerably fewer than in the previous year and the situation continues to improve with the reinforcement of the main transmission system. Although load spreading had been discontinued (with the exception of S.E. and S.W. Scotland) load shedding was necessary on only one occasion. The Report contains a short description of the Dalmarnock switchhouse explosions and fire.

Some 66,107m units were generated in the year, 7·3% more than in the previous year, and 62,121m units were sent out. Thermal efficiency (average) increased from 22·72 to 23·40 representing a saving of 1·1m tons of coal at an approximate cost of £3·5m.

Average works cost per unit sent out increased from 0·5446d. to 0·5594d., although heat consumption per unit dropped. The main reason for the increase lay in increased fuel charges. Costs of repairs and maintenance fell by 4·8%, and operation salaries and wages per unit sent out increased by 0·6%. Staff employed per MW of output capacity is now 2·2 compared with 2·36 in 1952/3.

Coal deliveries in the calendar year 1953 were 36·4m tons, of which 0·1m were foreign, mainly from screenings of imported coal for domestic use. Of the 36·3m tons of British coal, 30·6m were deep mined and 5·7m open cast. The percentage of East Midland coal used rose to 31·5%.

Commercial . . .

THE check which the industrial recession of 1952 caused in the Authority's load growth during that year was removed last year, shown by the much improved figure of 6·9% increased sales recorded. This compares with a 3·7% increase in 1952-53 and 8·2% in 1951-52. In all, total sales to consumers by the Area Boards amounted to 55,846 million units. It should be borne in mind, however, that apart from a cold spell of exceptional severity the winter of 1953-54 was notable for its mild weather, which will have had its effect on domestic demand, whilst the preceding summer was somewhat cooler than that of 1952. During the cold spell, the Authority supplied a maximum demand of 15,430 MW, some 1,883 MW above the maximum demand in 1952-53. On the same date (2nd February, 1954), the maximum potential demand was 16,309 MW.

Studying the Authority's commercial operations more closely, it is seen that, except for December, units sent out during each month exceeded those for the corresponding month of the previous year, the total for all twelve months being 62,121m units. To this total, 456m units were added, being purchased from outside sources. Of the total thus available 60,235m units were sold to Area Boards, who sold 54,830m units to consumers, which, added to the total of 1,016m units sold direct by the Central Authority, gives the total mentioned earlier. From the North of Scotland Hydro-Electric Board the Central Authority purchased 308m units. The supply notified to the Authority by the Scotland Board, under section 16 (1) of the Hydro-Electric Development (Scotland) Act 1943 (and 1947 amendment) remained unaltered from the two previous years, at 185 MW and 253·5m units. Under this section, the Authority purchased 277m units together with 31m surplus units.

Sales to Consumers

Of sales to individual classes of consumers, industrial sales showed a marked rise, being some 9·8% above those for 1952-53. Over 1951-52 they showed an increase of 12·7%, as against a rise of 4·2% in the Board of Trade index of industrial production. In the domestic field, where the 16,761m units sold were 2·9% above those for 1952-53, the effect on consumption of the increased availability of electrical appliances was masked to some extent by the comparatively mild winter. Railway traction sales totalled 955m units (2·4% higher), part of which was due to the commencement of supplies for the commercial operation of the Manchester-Sheffield electrified line.

During the year 529,685 more consumers were connected, bringing the total at 31st March to 14,383,714. This increase, some 3·8%, compares with 435,000 new connections made in 1952-53 and 426,000 the year before that. Since the end of the pre-vesting year, 1947-48, some 2,670,000 more consumers have been connected, whilst there are 4·5m more than the number at the end of the pre-war year 1938.

Turning to the subject of tariffs, a revised bulk supply tariff took effect on 1st April of this year. As will be recalled

TABLE V.—ANALYSIS OF AREA BOARD SALES TO CONSUMERS
(In thousands of kWh).

Area Board	Domestic	Farm	Commercial	Combined Domestic and Commercial	Industrial	Public Lighting	Traction	Total Sales to Consumers	Inter-Board Sales	Total Sales	% Increase in Total Sales over 1952–53	No. of Consumers
London ...	2,009,304	414	1,510,574	—	1,362,521	97,427	87,077	5,067,317	10,845	5,078,162	3·6	1,675,336
South Eastern	1,504,069	55,945	507,045	—	910,908	35,643	19,786	3,033,396	83,693	3,117,089	6·2	1,052,059
Southern ...	1,433,744	107,373	696,867	—	1,343,029	28,846	16,097	3,625,956	62,119	3,688,075	7·1	1,117,539
South Western	747,646	55,911	333,133	—	592,440	18,520	—	1,747,650	- -	1,747,650	10·1	647,983
Eastern ...	2,060,963	106,718	634,295	132,534	1,868,105	41,407	131,790	4,975,812	115	4,975,927	6·5	1,480,217
East Midlands...	1,276,834	86,251	441,106	38,616	2,396,585	32,309	21,179	4,292,880	—	4,292,880	7·1	1,120,051
Midlands ...	1,520,443	87,798	649,289	88,994	3,437,930	33,503	19,524	5,837,481	23,499	5,860,980	5·7	1,210,378
South Wales ...	449,856	17,532	236,004	—	2,674,232	20,878	8,105	3,406,607	15,918	3,422,525	8·1	529,584
M. & N. Wales	881,659	39,228	415,610	53,556	1,759,700	26,896	74,530	3,251,179	—	3,251,179	6·6	784,738
Yorkshire ...	1,296,391	39,960	539,854	32,946	3,644,882	44,365	124,329	5,722,727	3	5,722,730	4·6	1,320,845
North Eastern	703,943	27,550	356,874	—	2,198,197	23,080	63,212	3,372,856	33,902	3,406,758	6·3	820,814
North Western	1,563,388	80,475	763,164	—	3,848,483	55,852	41,922	6,353,284	23,548	6,376,832	8·8	1,463,831
S.E. Scotland ...	374,621	21,461	208,379	—	559,421	20,141	26,618	1,210,632	—	1,210,632	7·8	390,568
S.W. Scotland...	824,813	52,283	396,798	—	1,609,285	55,485	—	2,938,664	—	2,938,664	5·2	770,771
Total Area Boards	16,642,665	778,899	7,688,992	346,646	28,205,718	534,352	634,169	54,831,441	253,642	—	—	14,383,714
B.E.A.	—	—	—	—	249,322	—	766,441	1,015,763	2,031,526	—	—	—
TOTAL ...	16,642,665	778,899	7,688,992	346,646	28,455,040	534,352	1,400,610	55,847,204	—	—	—	—
% Increase total sales over 1952–53	2·8	15·7	4·3	88·8	8·9	7·6	—5·8	6·5	—	—	—	—

Commercial. — Sales up by 6·9% to 55,846 million units . . . increase to industrial consumers 9 8% and farms 15 8% . . . over half a million new consumers, 12,948 being farmers . . . all but one Board have standard tariffs . . . utilisation tests extended to include floor heating.

from the report given at the time, the new tariff revised the relation between fixed and running charges, raising the basic fuel cost and in consequence, the basic running charge. To reflect improvements in thermal efficiency, the rate of fuel cost adjustment was adjusted whilst the demand charge was increased. Further progress was made by Area Boards in simplifying and standardising retail tariffs, the South Eastern Board having introduced a new domestic two-part tariff based on floor area, with a running charge of 1d./unit.

Rural Electrification Progress

Whilst progress in Rural Electrification during the year was the best so far since nationalisation, the additional £1·5m allocated by the Government for this work last year has enabled Area Boards to plan wide extensions of rural supply in subsequent years. During the year, 12,948 more farms were connected, compared with 10,584 during 1952-53. It is estimated that some 285,000 farms come under Area Board's definitions of farms for tariff purposes, of which 152,500 (nearly 54%) had been connected at the end of the year. In the introductory section, the report points out that during the five years ending 31st March, 1958, Boards plan to take electricity to an additional 60,000 farms, and some 260,000 other rural houses and premises, at an estimated capital cost of £50m. Sales to farm consumers were 799m units (15·8% more than the previous year), whilst the average consumption per farm during the year was 5,107 units, which includes domestic use, although this average is markedly affected by a small proportion of farms having high individual consumptions of the order of 200,000 units or more.

On national fuel and power policy, the Report mentions the setting up of the National Fuel Efficiency Service, to which the B.E.A. at present contributes £100,000/annum, and briefly discusses the position with regard to private generating plant. Where the use of such plant contravenes the provisions of an existing supply agreement, the consumer would be offered a new contract leaving him free to use the plant to his advantage, whilst at the same time reflecting connection and supply costs.

Contracting and Trading

In its contracting activities, continued discussion ensued on proposals for establishing a National Inspection Council for Installation Contracting, and it is hoped that definite progress will be made in the near future. On the trading side, the measures of hire-purchase and purchase tax relief resulted in increased sales of storage water heaters and immersion heaters, appliances particularly conducive to fuel economy. The report hopes for further tax alleviation in the near future, especially as such appliances are particularly suitable for providing hot water facilities called for by the Government's programme for introducing modern amenities into older houses.

Utilisation research has been continued, the scope of tests to be made at 90 staff houses at Keadby Power Station having been extended to incorporate time switch controlled floor heating in six of them. Moreover, experimental dual purpose heat pumps will also be installed. Comparative trials of electric and gas heating referred to last year have been started, and observations will continue for twelve months. Other tests have demonstrated the excellent load characteristics of immersion heaters, that a change-over switch between cooker and sink water heater effected no significant reduction in heat demand at peak periods, and that instantaneous water heaters of 12 kW loading were not used sufficiently to justify expenditure on the three-phase services required for such appliances. Other investigations are in hand, or planned, including consideration of mechanising the load research work, using portable load recording instruments whose tape records can be transferred to standard punched cards.

Administration . . .

DURING the year, two working groups set up as a result of the first report of the committee reviewing the organisation and administrative efficiency of the industry, themselves reported. They were concerned with delegation and with generating division boundaries. One result of their recommendations has been the experimental amalgamation of the Merseyside and North Wales and the North Western divisions.

In connection with the Electricity Reorganisation (Scotland) Bill, which was read a first time during the year under consideration, the B.E.A. were represented on a ministerial working party which made recommendations on consequential financial, technical and administrative aspects of the proposed legislation. After the bill was published, the Authority was given the opportunity of commenting on the practicability of the various provisions.

Both the Authority and the Area Boards continued to share in the work of a number of international organisations. During 1953 they were represented at the third International Congress on Electro-Heat, at a German supply company organisation's meeting on the same subject, and at a convention of the German Association of Owners of Large Boiler Plant. Members of the staff also travelled to Canada, the U.S.A. and various European countries to discuss problems of particular interest to the Authority. Representatives of the Authority attended meetings of the O.E.E.C. and the U.N. Economic Commission for Europe as members of U.K. official delegations. The Commercial Manager of the Authority was seconded to the International Bank for Reconstruction and Development for twelve months, to assist in the technical and economic appraisal of certain power developments in Mexico.

Statutory consent was obtained during the year for the erection of three new generating stations and for extensions to six existing stations, covering the installation of 1,185 MW in all. In one case (Machen) consent was refused. In addition, wayleaves were negotiated for 556 route-miles of grid lines, of which 295 will operate at 275 kV. Only in respect of 7¼ route-miles had compulsory powers to be exercised. At the end of the year, negotiations were proceeding for a further 1,115 route-miles, including 559 to operate at 275 kV.

As a result of a representation made to the Authority by the Eastern Consultative Council, a meeting was held between Authority and Council, the Eastern Electricity Board being represented. The E.E.B. later proposed tariff modifications implementing national recommendations, which were accepted by the Council as resolving existing

Personnel . . .

NEW feature of the section of the report dealing with employment and staff relations is a more detailed functional classification of employees (see Table VI). The total of 184,652 for the Central Authority and the area boards, at 31st March last, is up by 1·9% on the same date in 1953. Practically all the increase has taken place in the technical engineering and manual grades, which together make up 73·1% of all employees. These figures have to be seen against a background of 8·8% increase in generating capacity and 3·8% increase in numbers of consumers.

During the year there were a number of important negotiations on wage scales and salaries. A joint committee of N.J.B. members was set up to examine the national agreement applying to technical engineering staff. Aside from salary matters, joint consultation continued on a wide range of subjects. The groups of items most often discussed during the year were education and training, the operation of the suggestion scheme, and safety. Many meetings were organised to allow local Advisory Committees to report on their work to the employees represented.

During the year, in spite of close attention to all aspects of safety, there were 12 fatal accidents among employees of the Authority, and 1,978 accidents causing the injured person to be off work for three days or more. For the Area Boards, corresponding figures were 9 and 4,330. Most of the accidents were due to handling objects or falling. Only 1·7% in the divisions and 4·5% in the Area Boards were directly caused by electricity.

TABLE VI.—EMPLOYEES OF THE CENTRAL AUTHORITY AND THE AREA BOARDS
(at end of March, 1954)

Generation Divisions	Managerial and Higher Executive	Tech. Eng.	Executive, Clerical, Accountancy, Sales, etc.	Manual	Technical Trainees, and Apprentices	Totals at End of March, 1954
London ...	22	1,052	787	7,470	160	9,491
South Eastern	11	420	250	2,078	55	2,814
Southern ...	10	382	309	1,712	218	2,541
S. Western ...	12	318	237	1,683	54	2,304
Eastern ...	12	463	277	2,150	68	2,970
E. Midlands ...	15	439	382	2,020	102	2,958
Midlands ...	14	493	402	3,047	125	4,081
S. Wales ...	11	344	281	1,957	112	2,705
Mersey and N. Wales ...	13	433	255	2,070	122	2,893
Yorks ...	16	575	401	3,491	244	4,727
N. Eastern ...	15	339	269	1,831	35	2,489
N. Western ...	18	882	502	4,159	201	5,762
S.E. Scotland...	7	87	70	532	7	703
S.W. Scotland	11	230	195	1,530	12	1,978
Totals, Divisions ...	187	6,457	4,617	35,730	1,425	48,416
Central Authority H.Q.	211	372	1,195	230	—	2,008
Totals, Central Authority ...	398	6,829	5,812	35,960	1,425	50,424
Area Boards						
London ...	60	1,075	4,631	11,732	287	17,785
South Eastern	86	483	2,699	5,764	271	9,303
Southern ...	66	725	3,226	7,192	549	11,758
S. Western ...	59	399	1,937	3,949	334	6,678
Eastern ...	95	796	4,204	8,096	855	14,046
E. Midlands ...	86	555	2,267	5,886	329	9,123
Midlands ...	102	771	3,243	7,182	893	12,191
S. Wales ...	43	481	1,727	4,571	435	7,257
Mersey and N. Wales ...	38	518	1,785	4,968	326	7,635
Yorks ...	72	750	2,672	7,350	430	11,274
N. Eastern ...	52	549	1,841	3,567	239	6,248
N. Western ...	62	1,112	3,372	8,006	682	13,234
S.E. Scotland ...	36	174	501	1,858	122	2,691
S.W. Scotland	46	346	1,275	3,277	61	5,005
Totals, Area Boards	903	8,734	35,380	83,398	5,813	134,228
Total Central Authority and Area Boards	1,301	15,563	41,192	119,358	7,238	184,652

Finance . . .

OUTSTANDING feature of the finances of the B.E.A. and Area Boards for 1953-54 is a record net surplus of £13·19m. With the addition of £5·57m brought forward from the previous year, £18·76m is available for appropriation. Table VII shows the division made. The total consolidated net surpluses since nationalisation amount to £41·52m, of which £18·57m has been transferred to taxation reserves, £9·99m is in the central reserve fund and £6·10m is in area reserve funds.

Combined revenues of B.E.A. and Area Boards were up by £34·90m on the year, of which £34m was due to sales of electricity. Combined expenses, including interest and financing were up by £28·99m only. In its 1951-52 report, the Authority stated its policy of applying surpluses largely in the creation of reserve funds, which would be available not only to meet occasional deficiencies, but also to assist in financing the replacement of assets. Previously to 1953-54, the attainment of adequate surpluses for the latter purpose was largely frustrated by rising costs. However, it is felt that the £5·53m remaining from the surplus after making provision for taxation is still not commensurate with the scale of the industry's operations.

TABLE VII.—CONSOLIDATED AND CENTRAL AUTHORITY ACCOUNTS 1953-54

Item (Figures for 1953 refer to consolidated accounts only)	B.E.A. and Area Boards Consolidated Accounts	Central Authority Accounts
	£	£
Sales of electricity ...	319,568,849	216,351,528
Sales of steam ...	592,995	592,995
Rentals ...	3,118,409	—
Income from public lighting maintenance ...	1,683,146	—
Surplus on contracting and sales of fittings ...	583,996	—
(1953: £290,640,678)	**325,547,395**	**216,944,523**
Deduct:		
Generation costs ...	146,448,616	146,448,616
Purchase of electricity from other sources ...	2,477,408	2,032,515
Main transmission costs ...	2,033,910	2,033,910
Distribution costs ...	23,756,380	—
Consumer service ...	11,566,676	—
Meter reading, billing and collection of electricity accounts ...	8,255,597	—
Administration and general expenses ...	11,469,714	2,703,094
Training, safety and welfare ...	4,652,410	2,416,550
Research ...	242,900	242,900
Rents, insurance, etc. ...	2,170,333	997,484
Payment in lieu of rates ...	14,754,581	7,236,296
Supply system changes (consumers' apparatus)	1,199,371	—
Depreciation of fixed assets ...	48,744,250	23,102,709
(1953: £254,435,666)	**277,772,146**	**187,214,074**
Consolidated Net Trading Surplus:		
(1953): £36,205,012)	**47,775,249**	**29,730,449**
Add:		
Income from subsidiary companies ...	24,912	24,912
Rents receivable and other miscellaneous income	985,706	35,345
(1953: £1,005,265)	**1,010,618**	**60,257**
(1953: £37,210,277)	**48,785,867**	**29,790,706**
Deduct:		
Interest ...	32,633,951	19,222,126
Financing expenses ...	963,178	556,853
Intangible assets: Amount written off "balance of consideration for undertakings acquired"	2,000,000	2,000,000
(1953: £29,929,454)	**35,597,129**	**21,778,979**
Consolidated Net Surplus for Year:		
(1953: £7,280,823)	13,188,738	8,011,727
Balance brought forward from previous year ...	5,571,061	2,029,289
(1953: £12,290,021)	**18,759,799**	**10,041,016**
Add:		
Transfer from central reserve fund ...	250,000	—
Provision for Profits Tax 1950–51 not now required (1933 : £250,000) ...	—	—
(1953: £12,540,021)	**19,009,799**	—
Deduct:		
Transfers to taxation reserves ...	7,663,000	5,436,000
Contribution to Central reserve fund ...	3,134,000	3,000,000
Transfer to Area reserve funds ...	1,350,000	—
(1953: £7,118,960)	**12,147,000**	**8,436,000**
Less: Transfer from Area reserve funds (1953 : £150,000) ...	—	—
(1953: £6,968,960)	**12,147,000**	**8,436,000**
Balance carried to balance sheet:		
(1953: £5,571,061)	**6,862,799**	**1,605,016**

Analysis of the combined revenues indicates that industrial consumers provided about 42% of total receipts, domestic consumers about 33% and commercial and all other consumers, 25%. The highest rate of increase in revenue was in respect of farms. It was notable that there was a surplus (£0·58m) on the contracting and sales of fittings account, which last year showed a deficit. Combined expenditure was largely made up of fuel costs (34·00%), labour costs (22·30%) and capital charges (24·48%). Fuel costs were up by £11·69m, of which £4·17m is accounted for by increased generation, and £7·52m by higher fuel and transport costs. Had there been no improvement in thermal efficiency during the year, fuel cost would have been a further £3·49m up.

Cost of generation rose by 0·0296d./unit to 0·7295d., 0·0138d. of the increase being due to works cost increases, and 0·0158d. largely to increased capital charges.

Wage awards during the year account for £3·38m of the £5·61m increase recorded under the salaries and wages heading. Cost of superannuation increased by £1·45m.

Capital charges brought into the revenue account total £84·33m, as compared with £73·20m last year. They thus account for 24·48% as against 23·55% of revenue expenditure. The increased depreciation provision is largely consequent on the bringing into service of new plant.

The taxation reserve, which figures so largely in the allocation of surpluses, is now intended to provide for taxation liabilities deferred through the operation of all capital allowances. Initial allowances will not be deducted in computing future annual allowances, and no deferred taxation liabilities will arise. The necessity for further contributions to the taxation reserve will, therefore, need to be considered during 1954-55.

Altogether, surpluses were made by the Central Authority and twelve of the Area Boards. Deficits were recorded by the South Eastern Electricity Board (£0·11m) and the Eastern Electricity Board (£0·20m). Contributions to the Central Revenue Fund were not required from Area Boards generally, although the Central Authority made it clear that Area Boards which escaped contributing to this fund in the first three years of nationalisation, due to their financial position then, should seek to provide equivalent contributions out of future surpluses. A contribution this year from the North Western Electricity Board was in accordance with this understanding. In the course of a review of board finances for the first five years, in connection with rural electrification plans, the Authority decided that the unfavourable position of the South Western Electricity Board was likely to constitute a hindrance to forward planning, and it was decided to grant the Board £0·25m from the Central Reserve Fund.

At the end of the financial year, the fixed assets were shown on the balance sheet at £953·96m after making depreciation and other provisions. During the year there was a net increase of £113·98m. Total capital expenditure during the year, including depreciation and other provisions, was £169·80m. So far as the Central Authority was concerned, 83% of its expenditure related to power station construction, and 16% to the development of the main transmission system.

Finance. — Consolidated surplus of £13·19m was another new record . . . Only two Area Boards recorded deficits . . . Capital expenditure totalled £170m . . . Total cost of generation up to 0·7295d./unit s.o. . . . Surplus again on contracting and retailing . . . Area Board revenue per unit sold increases to 1·381d.

One main reason for the Authority's surplus is the exceptional increase recorded in the chargeable maximum demands of many Area Boards.

For the Area Boards, the "working margin," sales of electricity less purchase of electricity, remained at about one-third of income, the proportion it has been since 1951-52. Distribution costs were up by £0·45m mainly due to higher repair and maintenance expenditure. Contracting and sales of fittings showed a surplus of 1·8% on turnover compared with a deficit of 0·6%, mainly due to increased turnover, including a 50% increase in hire purchase.

The Minister's Report...

IN addition to matters mentioned in our review of the B.E.A. Report, the Report of the Minister of Fuel and Power summarises the intervention of the Minister in the field of general policy. Included are the extension of the annual commissioning rate from 1,750 MW to 1,950 MW in 1959 and 1960, and acceptance of the principle that provision should be made for extending supplies to further rural areas even when there was less prospect of an immediate economic return there than in other areas. In this connection, the restrictions on publicity and advertising were removed.

Twenty compulsory purchase orders made by electricity boards were confirmed by the Minister during the year and eight were still under consideration at the end of the year. 9,906 consents to overhead lines were issued. There were 42 cases of approval of protective multiple earthing, covering 106 applications.

TABLE VIII.—FINANCIAL RESULTS OF EACH AREA BOARD

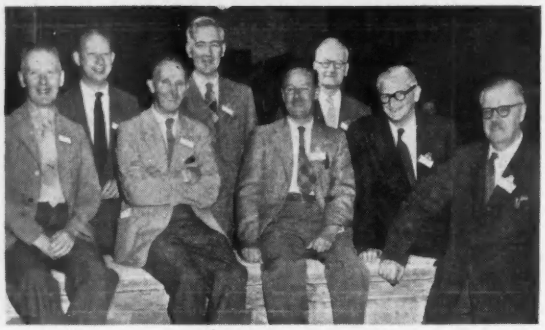
Area Board	Trading Revenue £	Trading Surplus £	Other Income £	Interest, Financing Expenses £	Net Surplus 1953–54 £	Net Surplus 1952–53 £	Transfer to Taxation Reserve £	Transfer * to other Reserve Funds £	Balance Carried Forward £
London	39,408,901	2,376,346	218,460	1,434,797	1,160,009	1,465,407	611,000	500,000	2,160,964
South Eastern ...	21,065,984	663,032	109,757	878,664	—105,875	174,402	—86,000	—	190,422
Southern	24,685,896	1,623,356	149,091	1,168,653	603,794	106,331	315,000	—	619,138
South Western ...	12,342,956	832,905	77,860	812,509	98,256	—148,967	—	*—250,000	29,955
Eastern	32,049,203	1,238,808	291,125	1,725,194	—195,261	—411,992	—	—	—304,501
East Midlands ...	23,492,137	1,463,110	82,776	1,304,911	240,975	—310,923	—47,000	—	302,350
Midlands	31,286,423	1,735,387	200,537	1,554,673	381,251	—641,603	—	—	4,537
South Wales... ...	15,223,398	728,401	44,369	579,522	193,248	356,345	111,000	100,000	588,352
M. & N. Wales ...	18,401,544	1,114,155	73,677	648,543	539,289	196,667	239,000	200,000	331,328
Yorkshire	27,640,255	1,385,523	195,777	1,312,157	269,143	—113,299	149,000	—	281,147
North Eastern ...	18,219,283	1,117,152	75,284	773,290	419,146	33,737	154,000	100,000	245,200
North Western ...	34,821,286	2,281,383	203,962	1,463,822	1,021,523	671,399	568,000	*584,000	516,930
S.E. Scotland ...	6,946,705	554,325	26,011	344,309	236,027	178,750	105,000	—	200,817
S.W. Scotland ...	16,333,675	930,917	25,235	640,666	315,486	—100,883	108,000	—	91,144
Totals	321,917,646	18,044,800	1,773,921	14,641,710	5,157,011	1,456,371	2,227,000	1,234,000	5,257,783

*All transfers made to Area Reserve except £134,000, for North Western Board transferred to Central Reserve Fund, and £250,000 for South Western Board transferred from Central Reserve Fund.

Lighting Decisions by I.E.C.

TUBULAR fluorescent lamps are the subject of a draft international specification which was before Technical Committee 34 of the International Electrotechnical Commission during its recent meeting in Philadelphia. Great Britain is accepting the specification, subject to detailed suggestions. The specification covers procedure for sampling and testing, gives detailed information on dimensions to ensure interchangeability, and specifies electrical characteristics. There was agreement in principle that the specification should include three colours for high efficiency lamps within the temperature ranges 6,500 to 7,000° K, 4,000 to 4,500° K, and 2,800 to 3,200° K, but the committee failed to agree to detailed colour objectives for these lamps. The trouble here is that various makers differ considerably in their measurement of the lumen output from lamps of a given colour. In an attempt to revolve this difference, lamps provided by the U.S. are to be the subject of measurements in America and Europe. The tests are to be completed in time for consideration at the International Commission on Illumination meeting to be held at Zurich next June. An I.E.C. committee of experts is to follow up this matter and others in order to complete the international specification.

British delegates to the I.E.C. Electric Lamps Committee, seen here at the Philadelphia meeting are, back row: Mr A. G. Penny, Dr J. W. Strange. Messrs G. T. Winch and J. F. Stanley; front row, Dr A. B. Whitworth, Messrs F. J. Hawkins, W. J. Jones, and A. J. Whittenham



Agreement was reached on the publication of a second edition of I.E.C. standard 64, tungsten filament lamps for general service. In this edition there is no table of average efficiencies. There was acceptance of data relating to reduced efficiency and light output associated with lamps having a life of 2,500 hours instead of the normal 1,000 hours. Useful agreement was also reached in connection with lamp caps and holders (I.E.C. Publication 61). Gauges for checking the interchangeability and safety of Edison screw cap holders were endorsed. Recommendations for fluorescent lamp ballasts were discussed, and detailed changes were made in the existing draft. In particular, a table was included dealing separately with chokes for 50 c/s and 60 c/s supplies, giving both "rated" and "objective" watts.

Thermal Station Prepares Way for Nyasaland Hydro

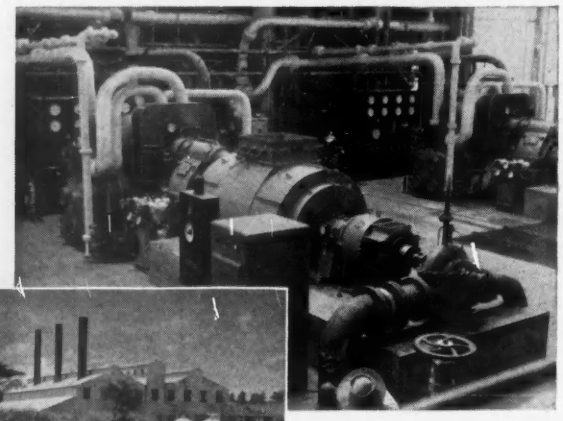
BLANTYRE and Limbe are important centres in the Shire Highlands in the south of the Nyasaland Protectorate. There are long term plans for the hydro-electric development of the Shire River, which flows near them, and in order to pave the way for this, extensions are being made to a thermal generation and transmission scheme for the two towns which should have an eventual capacity of 10 MW. Thus by the time the hydro scheme becomes practicable, a good demand should have been established.

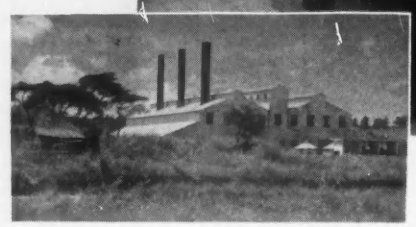
At present, the Blantyre/Limbe station, seen in the illustration, has a capacity of 2 MW. Sanctioned by the Government in 1949, the station is to have two further sets of 2·5 MW rating as a first extension. Primary transmission is at 11 kV, feeding both townships to give a 400 V, 3-ph., 4-wire, 50 c/s local supply.

The turbo-alternators are geared machines, 6,000/1,500 r.p.m., with generation at 11 kV. Together with 11 kV, 150 MVA switchgear, 400 V switchgear and all motors, they were supplied by Metropolitan-Vickers Electrical Co., Ltd. Steam is supplied from three 14 klb/hr, 400 lb/sq in., 750° F chain-grate fired boilers manufactured by Babcock and Wilcox Ltd. There is a spray cooling pond, the equipment for which was supplied by Ledward and Beckett Ltd. Feed pumps and evaporator plant are by G. and J. Weir Ltd., and cabling by Aberdare Cables Africa Ltd. The work was carried out to the specification of Mr E. W. Bechervaise, A.M.I.E.E., A.M.INST.F., Director of Electrical Services.

In addition to this new station, the Electrical Services Department has, since 1950, installed some 1,200 kW of diesel and hydro generating plant in the Protectorate. It has erected in addition 32 miles of h.t. and 40 miles of l.t. lines and 9 miles of underground cable. At the end of 1953, there were 1,881 consumers in the Protectorate, of whom 1,223 were in Blantyre and Limbe. Sales of electricity amounted to 3·13 m units, 2·03 being attributable to the two towns. The next largest consuming centre was Zomba, taking 0·82m units.

The new station was officially inaugurated at the end of April this year, at a ceremony attended by the Governor, Sir Geoffrey Colby.





Blantyre/Limbe station. Turbine house above, general view left

High Energy Linear Accelerator for Medical Research

TWO STAGE UNIT GIVES 15 MeV

SHORTLY to be commissioned in St. Bartholomew's Hospital, London, is a 15 MeV linear electron accelerator, which, when in operation, will provide the hospital with a highly powerful and valuable tool for its research into the best methods of treating cancer. At 15 MeV, this accelerator is probably the largest of its kind in use for medical purposes anywhere in the world, and certainly the largest in this country, the only comparable unit being another 15 MeV linear accelerator in use at A.E.R.E. Harwell for nuclear physics research. Both machines were manufactured by Mullard Ltd. at their Salfords laboratory, where opportunity was afforded last week to inspect the latest unit before it was dismantled.

The accelerator is particularly important as its high energy not only produces hard X-rays of such intensity that the skin deterioration resulting from lower energy X-ray treatment is reduced, but enables the electron beam to be used directly for treatment. Moreover, by employing a uranium target, neutrons are also made available for therapeutic purposes, the effect of which on living tissue has yet to be investigated. The hospital intends to devote the first two years of its work with the accelerator to exploring the usefulness of these forms of radiation for treating malignant growths. At the same time they are to undertake a more fundamental research into the effects of all three radiations—X-ray, electron and neutron—on both normal and abnormal living tissue. At the end of this research programme, the accelerator will then probably be available for treating patients, with the advantage, that for conventional treatment, the high energy enables not only deep-seated tumours to be attacked but permits shorter treatment times for those nearer the surface.

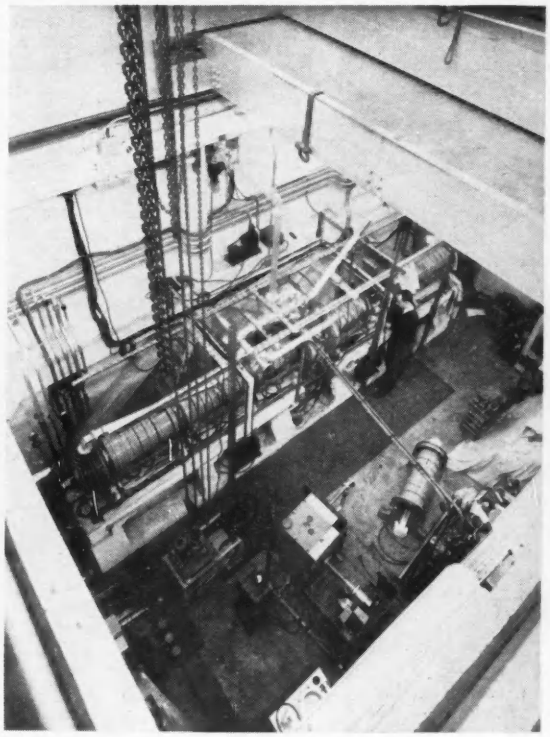
Advantages of Linear Accelerator

Several means are available for producing electrons at energies above 1 MeV (the limit for conventional X-ray tubes), but the linear accelerator is particularly suitable as, at a given energy, its available beam current is considerably greater than accelerators (such as betatron and synchrotron) which employ a magnetic field to move in a circular or spiral orbit. In principle the linear accelerator employs an ultra high frequency radio wave, generated in a magnetron, which is made to travel along a circular wave guide. The wave guide has a special corrugated construction which causes the radio wave to accelerate as it travels along the guide, and electrons, injected at the input end, are accelerated with it.

In the Mullard 15 MeV machine, a 10 cm radio wave is employed, generated in pulses from a magnetron capable of giving up to 2·2 MW of r.f. power in each pulse. The wave enters the input end of the 6 metre long wave guide at 40% of the speed of light, together with electrons travelling at the same speed, derived from an electron gun operating at 50 kV. During its travel the wave, and associated electrons, accelerate rapidly to 99·5% of the velocity of light and then, at this speed, the electrons gain further energy by increasing in weight some 30 times, due to Einstein's theory of relativity. As stated earlier, the accelerator is a two-stage unit, the r.f. output from the magnetron being divided, part entering the accelerating wave guide at its input end, and the remainder half-way along its length. To improve efficiency, surplus r.f. energy at the midway point and output end of the wave guide is fed back to supplement the input power.

At the output end provision is made not only to allow electrons to pass out in their direction of motion to strike an exterior object, but by subjecting them to a suitable magnetic field, their direction can be turned through 90° into the X-ray head. Here normally they strike a tungsten target to produce X-rays at a radiation level of 3,400 Röntgen/min. Comprehensive control facilities are provided, although a simplified panel is used when treatment is being given. Once these controls have been set, and the machine switched on, an automatic cutout operates to switch off after the correct dose has been given. Protective devices are built into the accelerator to cut off all or part of the equipment in the event of failure of the cooling water supply, accidental opening of the treatment room door or similar fault.

This view shows the 15 MeV linear accelerator set up at Mullard's laboratory, looking at the input end



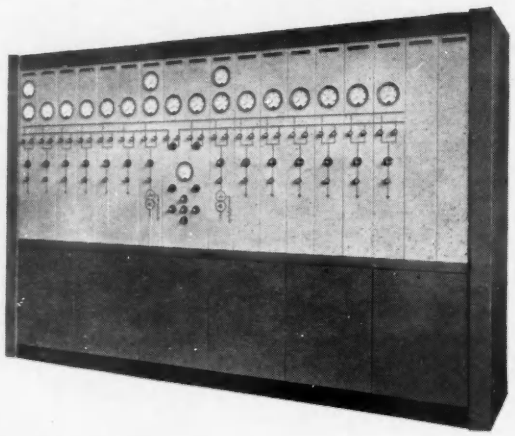
Miniature Control Equipment for a 6·6 kV Substation

THE latest type of miniature control equipment, using telephone type apparatus and wiring, is now being installed for the control and indication of the 6·6 kV switchgear at Guildford Substation. The equipment has been designed and manufactured by Standard Telephones and Cables Limited, for the South Eastern Electricity Board, who have adopted this type of equipment in preference to the more usual 110 V local control equipment. The compact nature of the control board can be seen from the photograph. It is some 10 ft 6 in. overall in length and contains all the apparatus necessary for the control and indication of the 16 breakers.

The South Eastern Electricity Board have installed wall-mounting boxes behind the switchgear, one for each breaker at which the connections to the switchgear terminate, providing means for terminating the telephone-type multi-core cable from the control board. These wall-mounting boxes contain interposing relays, protection relays and secondary current transformers for the meter readings. The whole installation is clean and compact and highly suitable for this type of control. Simplicity is the keynote of the design. The control board embodies semaphore-type keys, containing a lamp in the key knob which will indicate any break or isolator not in agreement with the semaphore position; this it does by means of a flashing lamp. Control is carried out by two-stage operation of the individual breaker key, and finally by the manipulation of a "common operate" key.

The compact nature of the equipment allows considerable saving in building accommodation, and the pilot cable runs between the main switch room and the control room are very much simplified: thus economies in building costs can be realised. The equipment operates from a 50 V d.c. battery which is installed in the substation.

On the left, below, is the front view of the panel. The compact nature of the assembly can readily be seen

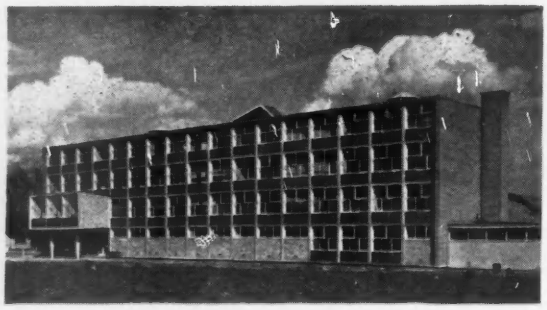


NEW COLCHESTER TECHNICAL COLLEGE OPENED

WITH its opening by Miss Florence Horsbrugh, C.B.E., M.P., last Thursday, the first instalment of the new technical college at Colchester makes a substantial contribution to facilities available in north-east Essex for training and instruction in technical subjects, not a small part of which will be those in electrical engineering.

For electrical studies, the four-storey block houses an electricity lecture room/laboratory equipped largely with equipment to demonstrate fundamentals of electricity and magnetism. For advanced students is the electrical engineering laboratory in the workshop section; equipped with machines and equipment necessary for H.N.C. and City and Guilds students. The main supply units here are a 7 kW motor generator set (E.C.C.) and a 10 kW Nevelin glass bulb demonstration type m.a. rectifier, both giving a d.c. output at 110 V. For a.c. supplies at the same voltage, and also at 65 V, use is made of a Ferranti oil-cooled transformer, all supplies being taken to a specially-designed

This photograph (reproduced by courtesy of the "Essex County Standard") shows the attractive appearance of the Colchester Technical College



Varilectric control panel, which employs their switch units and Chilton miniature c.b.s for overload protection. From this panel, supplies may be distributed as required, a six wire ring circuit, with linked terminal panels distributed at intervals round the laboratory, being used. A further laboratory provides facilities for modern wiring work, cable jointing, and the repair and testing of motors and domestic appliances.

With a total connected load of some 350 kVA, the electrical installation of the entire building is supplied at 415/240 V a.c., controlled at the intake point by a Dorman and Smith 750 A t.p.n. air c.b., of rupturing capacity 25 MVA. From here, supplies are taken for lighting and power through fused switches of the same make, using Henleys' v.r.i. cables drawn into steel conduit. Considerable use has been made of cable trunking to avoid multiple conduit runs. In the wood working and metal working machine shops, the English Electric o.h. busbar system has been adopted, with emergency stop buttons dispersed round the walls to stop all machines in case of a possible accident. For lighting, the Enfield Grid Suspension system has been adopted in the workshop, as precast concrete roof units precluded the use of conduit. Over 700 Benjamin "Saaflux" dispersive type fittings, with 100-300 W tungsten lamps, are installed for the general lighting throughout.

Consulting engineers for the electrical and mechanical services were W. S. Atkins and Partners, who with the Principal, Dr G. O. Stephens, Vice-Principal Mr A. Rigby and the staff of the engineering department were responsible for the design and layout of laboratories and equipment, Mr N. D. Cubitt, head of the electrical engineering section, being concerned with that part of the installation. A local firm, M.G. Installations Ltd., were contractors for the electrical installation.

From an engineer's notebook

SOME twenty years ago, a medical friend of mine was engaged in investigating a cure for a rather unpleasant form of insanity. The new treatment that was then setting the doctors' tongues awagging, rather reminiscent of a comic song of the period, was focused on the simple but drastic method of giving the patient a stiff dose of malaria: then he had to be cured of the remedy. Now they do things more scientifically and with the aid of a high frequency generator, fevers can be provided while you wait, by little more than twiddling a knob and taking a reading on the thermometer in the patient's mouth. Now, it appears, the medical profession wish to reduce the temperature of people's bodies. This appears to provide what has been described as an artificial hibernation which is said to reduce the risk of surgical shock and other undesirable complications of an operation. Here, a straightforward technique of refrigeration seems to be adopted and temperatures as low as 80° F are said to have been used. No wonder that in one of the cases it was found necessary to inject a drug to suppress shivering. This same drug it has been found, also upsets the thermostatic device which operates in our brain to keep our temperature constant, and in this way facilitates the lowering of body temperature. If this investigation continues long enough, perhaps, we may be able to save fuel by hibernating through the winter.

* * *

HIGH-SPEED photography has all the charm of the exploration of an unknown territory without the discomfort we usually associate with it, so, the announcement of a new camera with a speed some five times faster than the previous highest offers new possibilities of investigation into the realm of rapid action. Indeed with an exposure rate of fifteen million frames per second there can be few phenomena that cannot come under photographic analysis. Such a camera is not only novel in construction but presents some unusual features of design, since effectively no mechanical shutters are used, the basic method being to sweep the image along a strip of film to provide ninety-six consecutive images. A triangular mirror for deflecting the image is the centre of the design; it runs at 23,000 r.p.s. powered by a small helium-driven turbine; the whole running in a helium atmosphere. The published account does not make it clear how the individual separate images are photographed nor indicate the degree of definition obtained. Since the exposure must be of record shortness, however, even the fastest film that manufacturers can produce, will demand a high intensity of lighting and for non-self-luminous events, a form of argon flash is used. The feature of this camera which appealed to me as most novel, was the means adopted to cut off the image projection once the film had been scanned, to prevent a second sweep of the mirror. Incorporated in the optical system is a glass block which at the conclusion of the first sweep is shattered by an electrical detonation and the shattering provides sufficient opacity until the mechanical shutter can operate. Surely this must be the first time that the crashing of glass has been put to a scientific use.

* * *

SHOULD any scientific historian, in later years, come to write the history of this early atomic era he will not lack material, for hardly can one pick up a journal or a daily newspaper even, without seeing some reference to a new application of radioactive material. So intensive is research at the present time and so prolific the results, that it alarms me to think of how, in perhaps fifty years or less, the vast corpus of knowledge can be kept within the span of man's corporate mental capacity. But the realm of philosophy is hardly within the scope of these notes, so, with a touch of bathos, I must return to more mundane possibilities of radioactivity. Among the many by-ways of this vast subject, two references to its use in relation to food recently caught my eye. Sterilisation by means of radiation is, of course, a recognised method but with the advent of more convenient sources of gamma rays, their greater energy content offers a possibility of use in commercial sterilisation to avoid the normal heating process. Experiments with meat are said to have been highly successful with less deterioration in flavour than with normal tinned goods. That usual associate of meat, the potato, has also come in for gamma ray bombardment. The object in this case was to stop sprouting in storage with consequent shrinkage. It is reported that with a dose of 20,000 R using cobalt 60 as a source, sprouting was inhibited for up to eighteen months. While both of these applications are still in the experimental stage, they are indications of the breadth of radioactive investigations today.

* * *

OIL is something we take very much for granted. We put breathers on our transformers, change the oil after a c.b. has opened on fault, and filter turbine oil. From the simplicity of the way we use oil in practice, no one would suspect the volume of technical papers that fill library shelves on all aspects of the subject; it has been even accorded the distinction of a symposium all to itself. An approach to the determination of degree of ageing of oil that I have not seen before in any of this literature, comes from France. A study of the formation of the water droplets on oil caused by breathing on it, shows that different patterns are formed which can be seen under a microscope. On unused dielectric oil the small droplets were found to coalesce after a few seconds, to form chains with larger droplets at the points of intersection. On oils artificially aged for ten hours, the droplets do not so readily coalesce, while there is no coalescing on oil that has been in use for a considerable period. This behaviour is what one would reasonably expect and seems to be a delightful variant of the water separation test, which can be used by anyone with a microscope.

E. R. G.

Heavy Plant Prospects in Spain

RECENTLY issued by the Export Services Branch, Board of Trade, is a report on the market for heavy electrical equipment in Spain. As is well known an ambitious and rapid programme for the development of hydro-electric power is now in full swing, although many of the projects planned to come into operation during 1952 and 1953 are still lagging well behind.

In December 1953, it was announced that a plan had been submitted to the Council of Ministers which would increase power production to 15,500m units in 1958 8rising to 22,500m units by 1963. The capital expenditure on this programme is estimated at some £330m over ten years, and a proportion is to be spent on thermal plant to avoid power cuts due to water shortages. Iberduero, S.A., is at present building a 195 MW hydro plant at Saucelle and proposes to construct another plant at Aldeavila with a total capacity of 450 MW. Hydroelectrica Espanola has received approval for harnessing the middle Tagus at a cost of £5m and several of the smaller companies are engaged in extensions and new projects both hydro-electric and thermal. A vast new network of transmission lines is to be established, possibly using extra-high-voltage, to reduce the high losses now estimated at 22%. This should provide a useful export market.

Commercial potentialities include motors and control gear for steel and non-ferrous rolling mills. At the same time concentration is being directed toward the modernisation of the railways. Of some 13,000 km of railway track only 700 km are electrified and a further 700 km are in process of electrification. Considerations of finance and operating difficulties make it unlikely that large scale railway electrification will be feasible for some time to come. A market not to be ignored is that of trolley buses for municipalities and Madrid Town Council are enquiring for 50 trolley buses, and elsewhere in Spain tramways are being converted. Although most of the units are locally assembled many components are imported from abroad.

Internal Manufacture

Internal resources are capable of making horizontal generators up to 10 MW, vertical generators to somewhat less, small and medium capacity water turbines, transformers up to 50 MW, 138 kV, motors up to about 350 h.p., and medium pressure switch and control gear. There is little experience of the manufacture of steam turbines, and their auxiliaries which have generally to be obtained from organisations abroad.

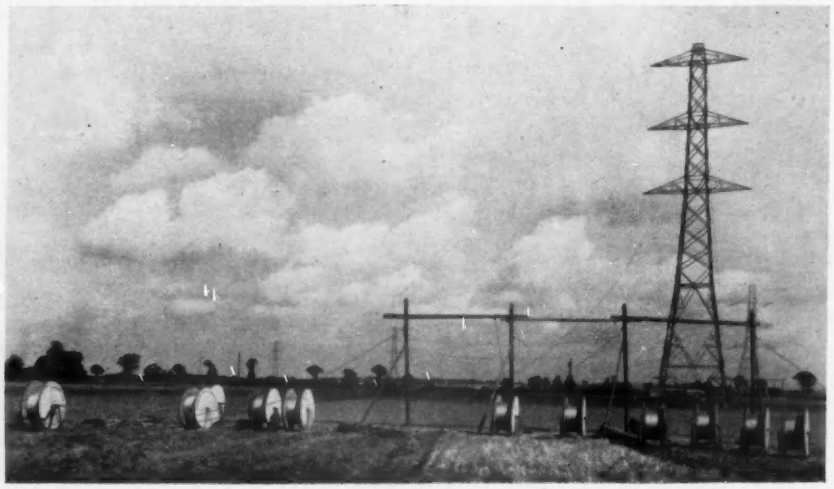
A summary of the Spanish opinion expressed about the electrical imports from various countries is included in the report which is available from the Special Register Information Service, Export Services Branch, Lacon House, Theobald's Road, London, W.C.1, quoting reference CRE. 29472/53.

Erection of Tilbury/Elstree 275/380 kV Line

THE story behind the erection of the Tilbury-Elstree section of the supergrid was unfolded in a film show presented by the J. L. Eve Construction Co., Ltd. Designed to operate initially at 275 kV the line is capable of being modified for use at 380 kV by changing the insulators and thus altering the conductor spacing. One of many, the tower shown being erected in the film was over 150 ft tall and weighed 22 tons and was built on an island in a flooded ballast pit, where there was just sufficient room for the foundations. A floating derrick 50 ft long, shaped like a hollow cigar, with sides only 12 gauge steel was used in the erection which followed the pattern laid down in a paper, "the erection of tall towers," read by the late J. L. Eve and R. C. Brown before the Institution of Civil Engineers. The Wallace toggle, invented by one of the firm's engineers, showed a foolproof means of shortening or increasing the effective length of steel ropes, used in erection operations, without using wire rope grips or sharp bends.

A tractor-hauled bridle was used for running out the 12 wires (13 when the earth-wire drum was in position), which were unwound from drums mounted on a type of stand first used in Sweden. This stand allowed the drum to unwind when the tractor pulled, and braked the drum when the tractor stopped. The bridle spaced out the conductors 6 in. apart so that they did not foul each other. Where a road was crossed, 6 wires at a time were hauled over specially-erected gantries thus ensuring no stoppage of traffic; this occurred similarly over a railway line. The conductors were also shown being hauled across a field of crops by means of the tractor winch, this avoided the tractors crossing the field.

Sagging of the 0·4 sq in. twin conductors presented a difficulty due to the combination of the deflection of the angle towers and the non-elastic stretch of the conductors. This was overcome by sagging two pairs simultaneously.



The illustration shows the conductors being run out from the cable-drums, which are mounted on a type of stand first used in Sweden

Tallawarra now on Load

NEW N.S.W. STATION SUPPLIES POWER TO FAST DEVELOPING PORT KEMBLA AREA

THE new Tallawarra power station of the Electricity Commission of New South Wales is of major importance to the Port Kembla area of that State as this area is developing rapidly and now ranks next only to Sydney and Newcastle. The station is on the western shore of Lake Illawarra, and is fortunate in that coal supplies are located comparatively near. The area has already a heavy demand for good quality coal for metallurgical purposes, and it was consequently decided to utilise for power production the lower grades of coal available. A new colliery was therefore opened up on the range about five miles west of the station to provide coal with a calorific value of about 10,600 B.Th.U. per lb, an ash content of about 25% and with an ash fusion temperature of some 2,300° F. This coal is at present being transported by truck, but later a conveyor belt system will be installed between the colliery and the station. About 1,000 tons per day will be burnt when the station attains 120 MW.

Plant

Ultimately the station will have a possible maximum capacity of 240 MW. At the moment the first 30 MW unit is running, three more 30 MW sets are on order—No. 2 due in March 1955, No. 3 in March 1956, and No. 4 in October 1956; and two 60 MW sets may follow.

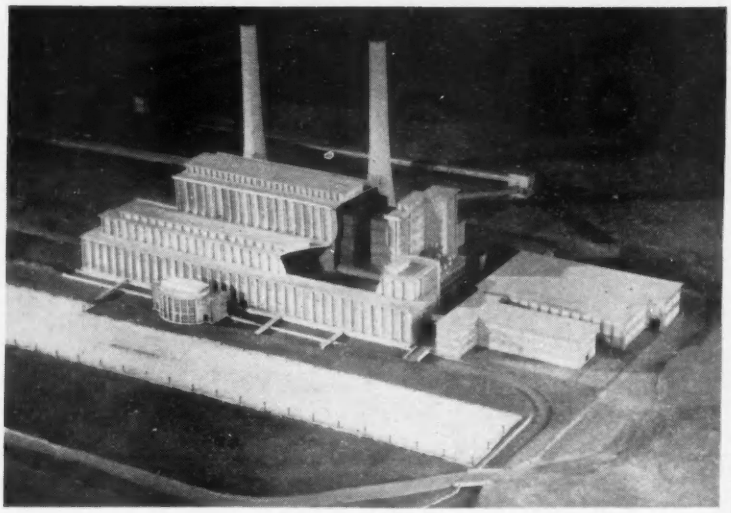
The administration building is finished; the control, stores and farmhouse buildings are under construction, and the main power station is proceeding from the northern end where No. 1 unit is operating and No. 2 unit is being installed. The completed chimney stack will serve all four 30 MW units and a second stack is projected for the additional 60 MW units. Cooling water is drawn direct from Lake Illawarra, the outfall canal discharging into the lake some 500 yards south of the intake.

Boilers are on the unit system with one 300 klb/hr boiler per turbine. Steam conditions are 625 lb/sq in. at 865° F, and the furnaces are p.f. fired with tangential firing from inclined burners. Main contractors for the boilers and all steel construction are Simon-Carves (Aust.) Pty. Ltd.

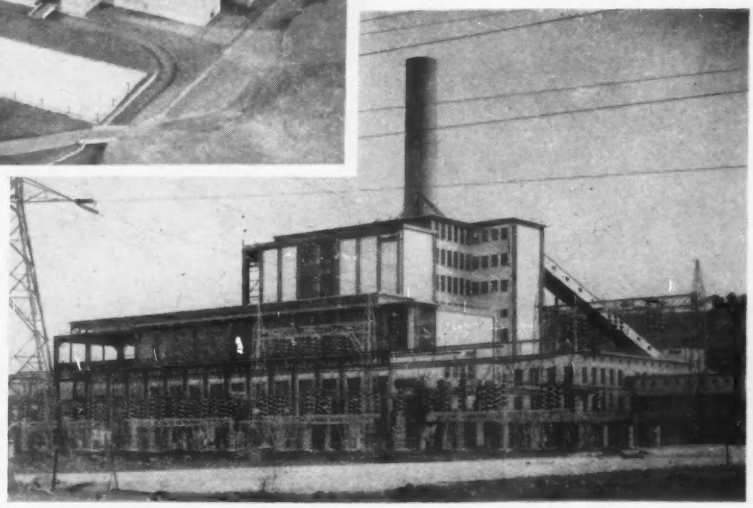
The four 30 MW British Thomson-Houston Co. turbo-alternators generate at 11 kV, 3,000 r.p.m. and contractors for this part of the plant are Australian General Electric Pty. Ltd. Each generator will be connected solidly to a 32·5 MVA, 11/132 kV transformer and connected through a 3,500 MVA, minimum-oil type circuit-breaker to duplicate 132 kV busbars. The switchyard is in front of the main power station building and will be interconnected by main 132 kV lines to Sydney, Goulburn and Port Kembla, thus tying in with the main New South Wales interconnected system which today supplies about 95% of all the power used in the state and now has a capacity of more than 1,000 MW.

Auxiliary supplies are provided by 4 MVA, 11/3·3 kV transformers connected solidly to the tail ends of each alternator. Every auxiliary motor over 100 h.p. will operate at 3·3 kV and smaller motors at 415 V. All auxiliary switchgear is of the air-break type.

Ash is conveyed hydraulically to ash wells and from there is pumped through pipes to a concrete flume which carries it to near-by ponds.



Simon-Carves model of the power station showing its appearance when 240 MW of plant has been installed



Right, A recent photograph of the station showing the switching compound in the foreground of the picture

Sydney Council's Year

A SURPLUS of £A579,950, representing the difference between an income of £A16,153,629 and an expenditure of £A15,573,679 is reported in the 1953 Annual Report of the Sydney County Council's electricity supply undertaking. Sales to the public totalled 1,292m units, a net increase over the previous year of 13·33%. This improvement in sales resulted from the lifting of restrictions on the use of electricity in the middle of the year and a marked buoyancy in commerce and industry toward the end of the year. Unit sales increases in the various supply groups were: industrial—85m; domestic—40m; and commercial—27m. The surplus is thus about the same as that of the previous year at £A580,000, although income from sales of electricity was £A2,286,405 in excess of the comparable figure for 1952. While the major portion of this increase is attributable to the greater volume of sales, additional revenue was derived by the higher tariff introduced, the average price per unit being 2·904d. as compared with 2·811d. Sundry income amounted to £A514,594, an advance of £A44,827 on the total for the previous year.

It must be remembered that the County Council does not carry out generation itself but purchases power from the Electricity Commission of New South Wales. Major works carried out during the year included a 54 MVA substation (City North) connected by cable to Pyrmont "B," and several other substations have been uprated. During the year 66 new distribution centres were placed in service and extensions were carried out on the 11 kV and l.v. networks. Ring main techniques using single circuit-breaker control and protection have been applied.

A "unit" type substation, incorporating the single circuit-breaker principle and suitable for outdoor use has been developed and a contract entered for the supply of fifty such substations. These substations will be completely equipped, with the exception of transformers, and will be delivered over a period of four years.

A short circuit and heavy current testing station to prove circuit-breakers and fuses has been completed, and investigations of frequency injection equipment for remote control of consumers' loading and street lighting continued.

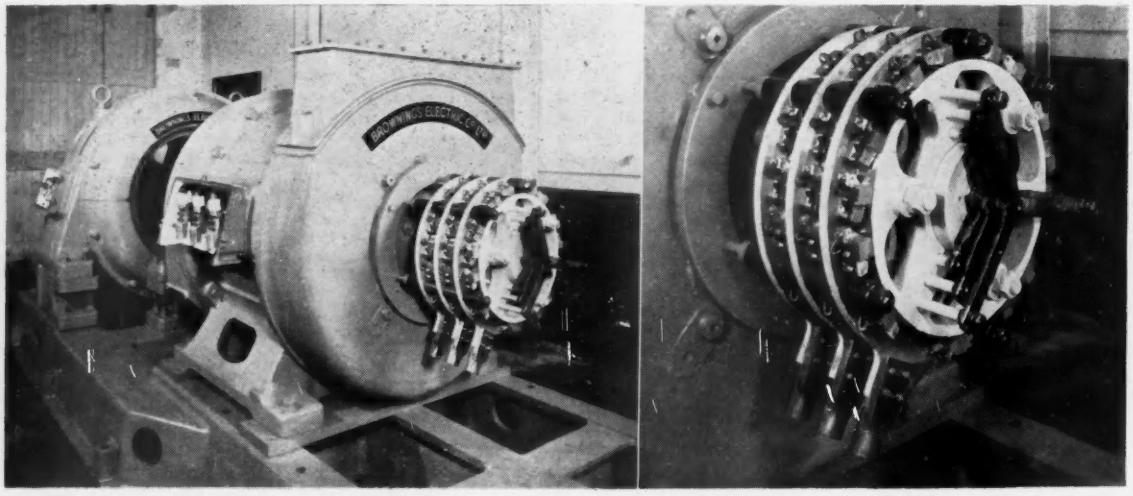
An Emergency Frequency-changer

CONFRONTED with an urgent requirement for a 750 kVA frequency-changer to give an output at 57 c/s, Browning's Electric Co., Ltd., investigated the possibility of rewinding existing secondhand machines to act as an induction frequency-changer. It may be recalled that this type of convertor uses the rotating-field transformer action of a wound rotor machine in conjunction with the shaft rotation to give the frequency-change. In this particular case, the requirement was extremely urgent, and as the works concerned generated its own power, it was possible to accept fairly poor power factors at low loading. After considerable search, two machines were found: an English Electric slip-ring motor rated at 300 h.p. 362 r.p.m. 440 V, and a Metropolitan-Vickers Electrical Co. 900 h.p. motor, 4-pole, 3 kV stator and with rotor wound for 832 V.

These machines were rewound to convert the 300 h.p. motor into a 28 pole machine running at 210 r.p.m., under which conditions the output fell to 130 h.p., and the stator of the 900 h.p. motor rewound for 470 V, and its rotor reconnected to accept 400 V. Acting as a frequency-convertor, the 900 h.p. motor produces a rotating field with respect to the stator of (1,500 + 210) = 1,710 r.p.m. which provides an output of 57 c/s. Owing to the low speed of the set it was necessary to supply forced draught cooling to the frequency-convertor. The stator winding is in star with the star point brought out.

The rotor of the convertor is wave wound with two bars per slot, and the three leads are each split into three parallel conductors so that the three phases are brought out through each of the three holes in the shaft which lead to the main shaft tunnel to eliminate heating of the steel shaft by eddy currents. The nine leads are connected to three slip-rings and there are 14 brushes per ring to deal with the input of about 1,000 amps/phase.

The completed set on the test bed is on the left, together with, on the right, a closer view of the slip-ring assembly



Contacts for Heavy Duty

FURNACE FIRM ENTERS CONTROL GEAR FIELD

NEW designs of control gear, developed by the Italian firm of Officine Meccaniche Riunite are now being manufactured in this country by G. W. B. Furnaces Ltd., of Dudley, Worcs. The basic development involved in the new gear is the use of sintered tungsten-silver exclusively for contact faces. This material combines high electrical conductivity with remarkable hard-wearing properties, and it is claimed that compared with plain copper contacts, it gives a twenty-fold increase of life. In particular, it is stated that while experience shows that it is necessary to de-rate copper contacts as the frequency of operations (operations per hour) increases, no such de-rating is necessary when sintered contact faces are used. Contacts of this type also have a far greater resistance to chemical attack that have plain copper contacts.

Standardisation

Close attention has been given to standardisation and simplification of design in connection with the range of control gear to be marketed. A moving arm of rectangular cross-section steel has been made the basis of the design, and this turns on the hardened steel conical bearing points of adjustable screws situated at each end. It is considered that this simple arrangement is superior to using ball bearings, a step which is sometimes advocated. Tests are stated to have indicated no appreciable wear over 10 million operations.

Three design series of operating coil cover the whole series of a.c. and d.c. contactors. They are a.c. operated up to 350 amps, d.c. operated up to 350 amps, and d.c. operated for both a.c. and d.c. contactors from 500 to 1,400 amps. There is a single standard type of auxiliary contact for use on all contactors, and this is available for both normally open and normally closed duties. Two typical coil loss figures may be quoted. First, for a 200 amp a.c. contactor, the closing VA is 390 and the holding 72·5. Watt loss in the iron circuit during closing is 64 W, and while holding is 20·2 W. In the coil winding the loss during closing is 44 W, and while holding, 16·5 W. For an 800 amp d.c. contactor the loss in the magnet during closing is 350 W, and during holding, 25 W.

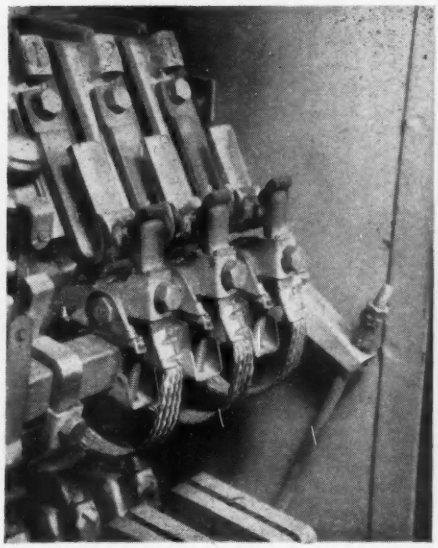
Practical Advantages

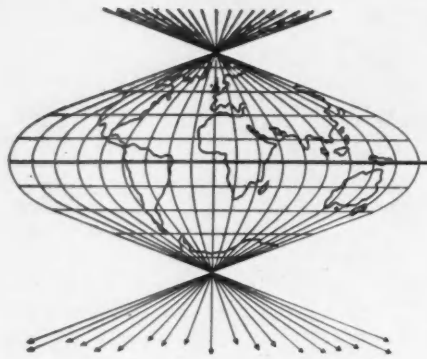
Examples from actual practice illustrate the type of advantage which may follow careful control gear design. The first concerns an industrial process in which carbon-black was being used. Because it was finely divided, the carbon-black was almost always suspended in the atmosphere, and it was a cause of repeated burning out. A change to a suitable moulding material for the main pole base insulators, which is now standard practice, eliminated this trouble with tracking. One of the illustrations below shows contactors which have been used for inching duty over a long period without giving any trouble.

In another case, a machine was working on a heavy plug-reversing cycle. When first set up, the machine reversed between 60 and 85 times in the first 30 minutes and later settled down to steady running. This initial heavy-duty period was liable to occur three or four times a day. With conventional type copper contacts, it was necessary to clean the contact faces with emery cloth every day, to file them every three days, and to replace them after three weeks. It is claimed that when a sintered contact was used in a G.W.B. contactor unit, there was only slight wear after ten weeks of operation.

Finally, the case of a small motor-starter panel working in a salt works may be mentioned. Here the ability of the tungsten-silver equipment to stand up to corrosive conditions has shown to particular advantage, as the atmosphere is humid and salt-laden.

On the left, below, are seen contacts with sintered tungsten—silver faces (arc shield removed) after 3½ years on inching duty. On the right is a general view of the G.W.B. assembly shop





OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Sharing Power

British Columbia will demand a share of power from Libby dam in Montana and other Columbia River hydro-electric projects planned in the United States. This was announced by Mr R. Sommers, Lands and Forest Minister, after he had met the Columbia River Basin Development Advisory Committee recently to iron out problems regarding payments for upstream and downstream benefits from a number of power dams in B.C. and the U.S. These payments were discussed in terms of the Libby project which will flood an area of about 40 miles into Canada. The results of the study now being undertaken by an engineering sub-committee, the Minister said, would set the pattern for other projects, and might be applied to Seattle City Light's Ross dam on the Skagit River, and later to the proposed $400 million Mica Creek dam.

Cable Laying

The task of laying four power cables 28 miles across the St. Lawrence River has just been accomplished by the 8,000 ton *Monarch*. The cables stretch from Manicouagan on the north shore of the river to Les Boules in the south, about 250 miles down river from Quebec City. Ultimately, the cables will transmit power from the Bersimis River hydro-electric scheme for the Quebec Hydro-Electric Commission. The 240 mile Labrieville-Murdochville link will be only one section of a power network which by 1960 will consist of about 800 miles of transmission lines reaching as far west as Montreal.

Early Atomic Power

An eminent scientist from Canada's Chalk River atomic energy works has revealed hopes of the early cheaper production of electricity from the atom. He is Dr G. C. Laurence, Research Director for Chemistry and Reactor Engineering at Chalk River. In a dinner speech at a scientific gathering last week, he said. "We are making good progress toward the economical production of electricity by atomic power. By the early 1960's we think it will be possible to produce electricity in central power stations more economically than with coal."

Interior Work

The proposed distribution system for the suburban area outside the Prince George city boundary has been the subject of discussions between the City Council and the British Columbia Power Commission. The Commission is suggesting a form of partnership to construct the network, it seems. Meanwhile Mr T. H. Crosby, chairman of the Commission, has told the City Council that all energy is being used in extending power lines in the central area of the province, which covers the region around Prince George.

BRAZIL

Concession Trouble

According to press reports, the state governor of Espirito Santo, Brazil, has asked the federal Council of Water and Energy to cancel the concession granted to Companhia Central Brasileira de Forca Electrica for the supply of electricity in Vittoria, Cachoeira de Itapemirim and other towns in that state, on charges of "negligence." The announcement was preceded by a campaign in newspapers against foreign "monopolies."

We also have news that a special credit of 330 million cruzeiros (about £2 millions) has been granted for the Euclides da Cunha and Limoeiro power plants now under construction in Brazil on the Rio Pardo.

EUROPE

Traction Orders

The Spanish Ministry of Works has placed contracts for narrow-gauge railway equipment, totalling 285 million pesetas, with Spanish, French and German firms as follows: (*a*) Twenty diesel-electric locomotives, 850 h.p., total value 74 million pesetas: Contract awarded to General Electrica Espanola, Sociedad Espanola de Construcciones Babcock-Wilcox, Euskalduna (all Spanish) and Alsthom of Paris, jointly: (*b*) Ten diesel-electric locomotives and 10 diesel-hydraulic locomotives, all of 675 h.p., total value 64 million pesetas: Contract awarded to Sociedad Espanola de Construccion Naval, Constructora National de Maquineria Electric (both Spanish), Societe des Forges et Ateliers du Creusot and Material Electrique Schneider-Westinghouse (both French), jointly. (*c*) Ten diesel-hydraulic locomotives, 500 h.p., total value 27 million pesetas: Contract awarded to Beasain (Spanish) and Batignolles-Chatillon of Paris, jointly; (*d*) Twenty-five automotive diesel railcars, 150 h.p., total value 37 million pesetas, and 10 trailer coaches, value 8·5 million pesetas: To Penarrova (Spanish) and Billard of Tours (French), jointly; and (*e*) Twenty-five automotive diesel railcars, 300 h.p., total value 63 million pesetas, and 10 trailer coaches, value 12 million pesetas: To Euskalduna (Spanish) and Ferrostahl of Essen (Germany), jointly.

Problem in Malta

Arising out of the reorganisation of the electricity distribution system in Malta, and the passing of the 1954 Act, there seems to be some complaint that consumers are having to bear costs for converting their own wiring systems, which were not earlier envisaged. As we have already noted, the distribution is being changed from 105/210 V to 230/400 V, 50 cycles, a.c. Under the Act, the Government will refund to the consumer the reasonable cost incurred by the latter in carrying out alterations necessitated by the reorganisation, except the cost of making an existing installation comply with the Electricity Supply Regulations. It seems that some consumers have found that under the Regulations three-pin plugs and sockets are required unless appliances are thoroughly insulated. It is stated that the Electricity Department has imposed a time limit within which the necessary alterations must be carried out, but there seems some doubt whether there are sufficient electricians to undertake the work.

Thermal Station Recommended

The Committee set up to study the development of the Ptolemais lignite mines in Central Greece has recently been informed by the Greek Public Power Corporation that in view of the delay in establishing the Megdova and Acheloos hydro-electric stations it is imperative that the 80,000 kW thermal power station at Ptolemais should be constructed as soon as possible. Expenditure on the Ptolemais station and the additions and extensions to the transmission network is estimated at $16,540,000, of which $11,380,000 will be required in foreign exchange and the re-

mainder in drachmae. The Public Power Corporation has undertaken to meet this cost from the balance of its availabilities and annual profits after meeting its commitments. Under present proposals the Ptolemais power station will supply 62,500 kW to the Athens area.

AFRICA

Nigeria Expansion

Recommending a development programme for agriculture, industry and other services in Nigeria, a mission sent by the International Bank for Reconstruction and Development also reports that the demand for electric power is expected to increase by at least 15% a year up to 1960, and the generating capacity already in existence will need to be greatly expanded. Nigeria's hydro-electric capacity has not yet been explored, it is stated. The electricity undertakings primarily concerned are, of course, the Electricity Corporation of Nigeria and the Nigerian Electricity Supply Corporation Ltd, both of whom are extending generating facilities and planning further ahead.

INDIA

Railway Contracts

The Indian Railway Board is seeking tenders from manufacturers in all parts of the world for electric locomotives and coaches to meet the requirements of a proposed railway electrification scheme. The closing date for receipt of tenders is 1 Dec. The area to be electrified comprises about 440 route-miles (1,032 track-miles) and 765 route-miles (1,795 track-miles) on the suburban and mainline section of the Eastern Railway. The gross cost is estimated at about 930 million rupees. Meanwhile, the Railway Board has ordered 12 electric trains, four-coach units, each comprising two motor-coaches and two trailer coaches, and two spare motor-coaches, from an Italian firm, Breda and Co. These 50 coaches, costing 12·7 million rupees, are to be delivered by Mar. 1956.

Two Sets for Trombay

After much agitation, the Tata organisation has now been granted a licence by the Government of India to install a second 62·5 MW turbo-generator and additional boiler plant at its new Trombay power station. The first set for which an order was placed with A.E.G. of Berlin, earlier this year, is to be a hydrogen-cooled machine, and we understand that the second set will be of similar type. The boiler plant is also being provided by a German concern. The new power station is intended largely to meet the demand emanating from two oil refineries. The plant, together with the 110 kV transmission lines and substation plant, is estimated to cost Rs. 30 crores. Tatas are receiving, with the consent of the Government of India, a loan from the World Bank to cover the cost of the imported plant.

AUSTRALIA

Old Stager

Probably the oldest hydro-electric scheme in Australia, the Duck Reach power station, near Launceston, Tasmania, is to be taken out of commission next year when the Trevallyn power project is expected to be completed. The old station has served Launceston well for nearly 60 years, and has played a big part in the development of the city. The station was operated by the Launceston City Council until 1944, when it was compulsorily acquired by the Hydro-Electric Commission.

It was completed in 1895, and provided for an output of 1,650 h.p. During the years the station has been in operation additional equipment has been installed, and it now has an output of 2,600 h.p.

NEW ZEALAND

Protests at Levy

Outlying areas served by the electricity undertaking of the Dunedin City Council, New Zealand, are protesting at a proposal of the Council to apply a 10% levy on electricity accounts to offset the losses caused by the Council's transport system. The regions in question, it seems, are not themselves served by the Council's transport system, and therefore object to the suggestion that they should help to reduce the losses. Representatives of these bodies are to seek a meeting with the appropriate committee of Dunedin City Council on the matter.

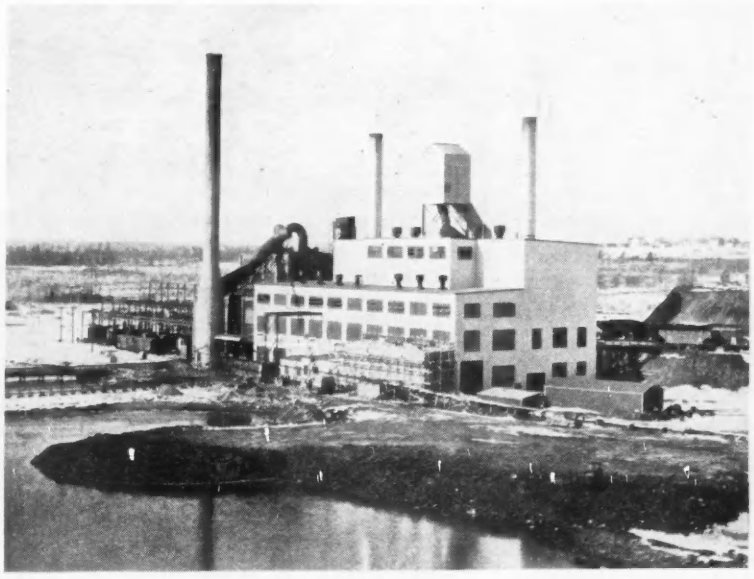
Need for More Power

The vital part played by the Electrical Supply Authorities Association of New Zealand in assisting the country, was emphasised by Mr C. J. Lovegrove, president of the Association recently. He said they had been constantly advocating that New Zealand should adopt a bold and vigorous policy in the generation of electricity, and if it had not been for the advocacy of the Association the position would not be as it is at present. The hydro resources of the North Island were nearly all utilised, and in his view it would be necessary to make use of geothermal power within the next few years. He did not agree that coal should be used for power generation.

FORMOSA

Increasing Capacity

In Formosa, a new hydro-electric plant at Liwu was put into operation recently. This has a capacity of 32,000 kW, bringing the total installed capacity of the Taiwan Power Co.'s installations up to 394,000 kW. Plant aggregating a further 140,000 kW is still under construction. This is mainly hydro-electric, but includes a 40,000 kW thermal plant at Keelung.



At the base load station of the Seaboard Power Corporation Ltd., on the north-west shore of Big Glace Bay Lake, Nova Scotia, shown alongside, a fourth 18,750 kVA turbo-generator has just been installed. This is a C. A. Parsons machine. Previously installed at this pulverised fuel fired station were two 7,500 kVA Brown-Boveri sets and another 18,750 kVA Parsons turbo-generator. The station has been built by the Dominion Steel and Coal Corporation (claimed to be Canada's largest private industrial enterprise) which also has another station located within its Sydney Steel Plant. Together the total installed capacity is 80,000 kW, but a fifth set is to be installed at its Seaboard plant in the near future. In addition to serving the needs of the Corporation's vast steel and coal industries the plant also supplies all the power requirements of other industries and of domestic consumers throughout Cape Breton, Nova Scotia. Installation of the No. 4 set at the Seaboard power station coincided with the erection of a transmission line from Glace Bay to a new substation at the Sydney Steel Plant.

Personalities

IN THE INDUSTRY

Secretary of the London Electricity Board since 1948, **Mr W. H. Warhurst,** LL.B., will probably retire from that position early next year, we understand. Prior to nationalisation of the electricity supply industry, he had been town clerk at Hammersmith from 1943 to 1948, and at Accrington from 1926 to 1943. Mr. Warhurst was also honorary secretary of the Conference of Local Authorities owning Electricity Undertakings in Greater London Area.

Mr C. J. Edmonds has been appointed a director of the Bagdad Light and Power Co.

Mr P. W. Dolan has been appointed sales engineer for Fenton, Byrn and Co., Ltd., and will be responsible for covering the North-Western territory, Lancashire, Wirral and West Yorkshire. He is at present working from his home address, 72 Mount Drive, Humphrey Park, Urmston, Manchester. Tel. No. Longford 1096. Mr Dolan has had many years' experience in the Ventilating Industry. Educated at St. Martin's College and the College of Technology, Liverpool, he was chief electrical engineer in the Merchant Service in diesel motor ships. During the war years he was employed on degaussing installations.

Mr R. A. Norrington has been appointed sales manager to R. Lowther Ltd, of Manchester. He has had seven years' experience as technical representative in the electrical and lighting fields.

District manager at Maidstone to the South Eastern Electricity Board since 1949, **Mr E. E. Pope,** M.I.E.E., retires at the end of September. His successor there is **Mr C. E. Hollingworth,** B.ENG., M.I.E.E., as we noted on 1 Apr. last. Mr Pope was born at Folkestone and started his career in 1905 with the Folkestone Electricity Supply Co. He subsequently held engineering appointments at Walton and Weybridge, with the Metropolitan Boroughs of Woolwich and Fulham and as charge engineer at the Watford and Erith power stations. He went to the Maidstone undertaking in that capacity in 1918, and the following year was appointed constructional engineer, being responsible for the erection of new turbo-generators and other plant. In 1921 he became mains engineer, three years later was appointed chief assistant to Mr E. E. Hoadley, the chief of the undertaking, and in 1943 was further promoted to deputy chief engineer and manager. Still in the best of health, Mr Pope intends to undertake private consulting work, we understand.

Mr E. E. England, outside sales representative and a director of Donkin and Co., Ltd., of Newcastle-upon-Tyne, is about to retire after 50 years' service.

Mr L. W. Moscrop has been appointed a director of Bylock Electric Ltd.

Mr E. W. Knapp has been appointed engineering assistant to the vice-president in charge of the Shawinigan Water and Power Co.'s Generation and Transmission Department. Mr Knapp has been with that department since 1925, and chief engineer for the past three years.

Appointed as Head of the Electrical Engineering Department of the Regent St Polytechnic as from 1 Nov. is **Dr D. O. Bishop,** PH.D., B.SC.(ENG.), M.I.E.E., M.AMER.I.E.E., who since 1948, has been senior lecturer in that Department. He succeeds **Mr W. H. Date,** B.SC.(ENG.), M.I.E.E. who, as we exclusively reported on 1 July, is shortly to retire. After obtaining his B.Sc.(Eng.) degree at Portsmouth Dr Bishop served with the British Thomson-Houston Co., Ltd., at Rugby, and for a short while at Willesden. In 1939 he joined the Educational Service of the R.A.F. and was demobilised as a flight-lieutenant in 1945. During that period he was attached to the Technical Training Command and was concerned with the technical training of R.A.F. personnel, including apprentices and engineer officers. He joined the staff of the Electrical Engineering Department of Portsmouth Municipal College in 1945 and two years later was promoted to senior lecturer, a post he held for a year before going to the Polytechnic. During the period 1948 to 1952 he followed a research programme at Queen Mary College, London University, under the supervision of Prof W. J. John. He did a great deal of experimental work in the Short-Circuit Testing Laboratories there and was awarded the Ph.D. degree in 1952.

Mr G. J. Wells, who has been associated with Engineering and Lighting Equipment Co., Ltd., St. Albans, for a great number of years, retires from all his activities with that company as from 30 Sept.

The General Electric Co., Ltd., announces that in addition to his present responsibilities as sales manager of the London and Southern England area, **Mr W. J. Bird** has been appointed deputy sales manager of the company. Mr Bird, who is 44 years of age, was educated at King Edward's School, Birmingham. He began his career with the G.E.C. as a student apprentice at Witton Engineering Works in 1925 and after some years on the engineering sales staff at Liverpool and Birmingham, was in 1940 appointed manager, Industrial Sales Department, Birmingham, and in 1942 assistant district manager, Midland Area. In 1949 Mr Bird transferred to head office as an assistant to Mr T. W. Heather, sales director, and on 1 July, 1950, was appointed London sales manager. He was well known in Rugby Football circles up to 1939 as a member of the Barbarians and gained an English Trial Cap. In recent years he has been closely associated with the organising body of the Electrical Industries National Golf Championship, of which he is now deputy chairman.

Mr P. W. Dolan

Mr R. A. Norrington

Mr E. E. Pope

Dr D. O. Bishop

Mr W. J. Bird

Mr K. E. Pickard

Mr R. R. Whyte

Mr O. H. Hosking

From Hirst, Ibbetson and Taylor Ltd. we learn that they have appointed **Mr K. E. Pickard,** manager of their Liverpool branch, a director of the company. That branch has become highly successful, we understand.

From the Metropolitan-Vickers Electrical Co., Ltd., we learn that **Mr R. R. Whyte,** M.B.E., B.SC.(ENG.), has assumed control of the company's Germiston Works, Glasgow, manufacturing steam turbine condensers and associated auxiliaries. This is in addition to his present responsibilities as superintendent, Small Turbine Dept. (Trafford Park). Educated at University College School and City and Guilds Engineering College, London, and at Freiburg University, Mr Whyte went to M.-V. as a college apprentice in February, 1933. After six months' extended apprenticeship at the Prague Works of the C.K.D. he joined the Turbine Experimental Department at Trafford Park, and two years later transferred to the Steam Turbine Manufacturing Department. In 1944 he became assistant superintendent, and in 1949 superintendent of the Gas Turbine (now Small Turbine) Department.

Manager of the Repair Department of the Midland Electric Installation Co., Ltd., **Mr G. W. Ryall** retires on 1 Oct. after serving that company for 30 years. At a luncheon given by the directors earlier this week he was presented with a refrigerator to mark his retirement. Mr Ryall is not severing completely his connection with the company, as he remains a director of the subsidiary, Shoolbred Rewinds Ltd. **Mr D. N. Brittain,** who has been assistant to Mr Ryall for many years, has been appointed the new manager of the Midland Co.'s Repair Department.

The Minister of Fuel and Power has appointed **Mr E. France** of Moreton, Wirral, as a member of the Merseyside and North Wales Electricity Consultative Council.

It is announced by Mersey Cable Works Ltd. that **Mr K. Silveston** has joined them as sales engineer for South-East England, in succession to **Mr C. J. Penny.** For the last four years Mr Silveston has been with Enfield Cables as sales engineer for the Brighton area.

Shortly to retire is **Mr O. H. Hosking,** M.I.E.E., who has been sub-area engineer of the Wolverhampton and District sub-area of the Midlands Electricity Board. Prior to nationalisation he was chief assistant engineer to the West Midlands J.E.A. for six years. Earlier he had served as chief assistant engineer with the Borough of Watford undertaking for 8½ years, having vacated the post of personal technical assistant to the chief engineer and general manager of the County Borough of Croydon Electricity Department to take up that post. A Cornishman, Mr Hosking comes from an old farming family. In the early 1920's he was engaged in agriculture with his father and two brothers under the style of "W. L. Hosking and Sons", and won many prizes at the leading agricultural shows for pedigree livestock. He was treasurer of the Cornwall County Milk Recording Society and was also a member of the Truro Rural District Council.

For health reasons and acting under medical advice, **Mr S. A. Millington** has reluctantly found it necessary to resign his position with J. H. Tucker and Co., Ltd., and the Kersons Manufacturing Co., Ltd. With each firm he held the position of director and general manager—he has been with J. H. Tucker and Co., Ltd., for 44 years, originally joining the company when their address was Sampson Rd North. Mr Millington is at present on holiday in Cornwall, his address being Gull Cottage, St. Agnes, where he will be residing for some time and during further medical treatment, which we hope will be highly beneficial.

Mr D. S. Johnson, formerly electrical development engineer at Platt Bros. and Co., Ltd., has joined the sales staff of the British Thomson-Houston Co., Ltd., Manchester Office. He will specialise in the application of electrical equipment to textile machinery. Mr Johnson was educated at Rochdale and Manchester Technical Colleges.

Sir George Usher, who is still an active director of both International Combustion (Holdings) Ltd., and Aberdare Cables, Ltd., is on a short visit to this country in connection with the companies' business. Sir George, who now lives in South Africa, is chairman and managing director of International Combustion Africa Ltd., and a director of Aberdare Cables (Africa) Ltd.

OBITUARY

Mr J. H. Payne, engineer of the Leicester sub-area of the East Midlands Electricity Board, died on 23 Sept. Educated at the Higher Grade Public School, Broxburn, West Lothian, he received technical training at the Heriot Watt College, Edinburgh, and was with the English Electric Co., Ltd., as engineer on outside contracts before joining the Leicester Corporation Electricity Department in 1924 as mains engineer. He became mains superintendent in 1942.

Mr A. B. Cooper, B.SC., M.I.E.E., a director of Ferranti Ltd., died in Toronto, Canada, recently, aged 70. He had been associated with Ferranti Electric Ltd., Mount Dennis, Toronto, since 1922 when he was appointed general manager. In 1942 he became president of the Canadian company and was elected to the board of the parent company of Ferranti Ltd., in Mar, 1947. Mr Cooper was born in Belleville, Ontario. He graduated from Tufts College in 1903. After two years with General Electric and a year with Westinghouse, Mr Cooper joined the Brazilian Traction Co. He assisted in the construction of the first hydro-electric generating station transmitting power to Rio de Janiero. He returned to General Electric in 1908, in 1913 went to Canadian General Electric in charge of transformer sales and in 1922 joined Ferranti. Active in the organisation of the Canadian Electrical Manufacturers' Association, Mr Cooper was its first President. He served as director of the Toronto Industrial Commission and as President from 1951 to 1954. He was a past President of the Engineers Club of Toronto and of the Association of Professional Engineers of Ontario. He was a past Vice-President and director at large of the American Institute of Electrical Engineers.

Mr A. B. Cooper

Mr H. G. Yates, senior designer for the Parsons and Marine Engineering Turbine Research and Development Association, died last week, aged 46. He joined that Wallsend organisation in 1944 from the English Electric Co., Ltd., Rugby, where he was in charge of the Turbine Dept.

Mr J. Webb, C.M.G., C.B.E., M.C., M.I.E.E., who died at Gwels, Southern Rhodesia, on 12 Sept., was appointed Inspector-General of Egyptian State Telegraphones and Telephones in 1931, but retired from that post some time before his death.

Mr D. R. A. Pistor, a director of B. K. B. Electric Motors Ltd., and for nearly forty years manager of the Hibbert St works of George Kent Ltd., died on 23 Sept. while on holiday in Scotland.

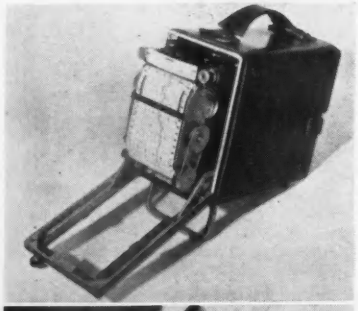
Equipment for Industry

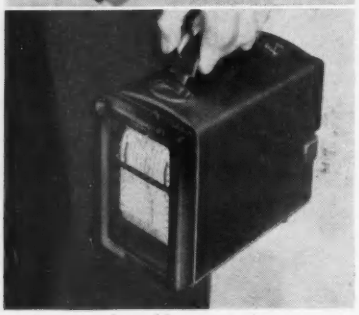
Miniature Recorder

THE modern tendency to produce smaller and smaller industrial control equipment has led to the development of the new miniature recorder which is being produced by EVERSHED AND VIGNOLES LTD., Acton Lane Works, Chiswick, W.4, and is suitable for recording voltage, or current, a.c. or d.c. and for temperature measurement, operating directly from base-metal thermocouples. The instrument measures only 4¼ in. wide by 6½ in. high, with a depth of 9 in. and is suitable for either flush or projection panel mounting by use of special steel straps or is portable, having leather sling and handle.

The recorder is of the tapping type, operating at the rate of 12 taps/minute, with chart speed ½ in./hr. Straight time lines and hence rectangular co-ordinates enable the record to be easily read and integrated if required and the chart is printed for 24-hour operation and lasts 31 days at normal speed. Change gears are supplied which enable chart speed to be altered to 1 in., 10 mm. or 20 mm. per hour.

By opening the front of the recorder, the clock case and movement unit is partially withdrawn from the case, giving easy access for adjustments and for chart and ribbon to be changed. The recorder is driven by a self-starting synchronous motor and recorder movements are of the moving-coil and rectifier-operated moving-coil types, having a sensitivity down to 1 mA for full-scale deflection with a resistance of 250 ohms. Speed of response is 0·8 seconds for full-scale deflection. The maximum ranges are 500 V and 10 amps.

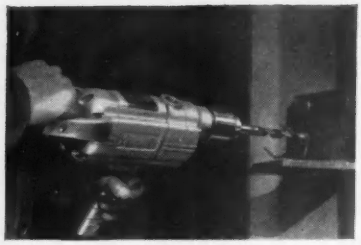




Fitting new charts is a simple process on the new Evershed miniature recorder

Portable Electric Drill

LATEST in the range of pneumatic straight drills produced by DESOUTTER BROS. LTD., The Hyde, Hendon, N.W.9, two new models capable of drilling up to ⅜ in. and ½ in. diameter holes are suitable for most drilling operations. A ⅝ h.p. motor, type S.R., is fitted in both these models which are claimed to be the smallest and lightest portable drills of their type. Their weight being approximately half of similar capacity tools.



These robust drills provide great power compared with their size and weight

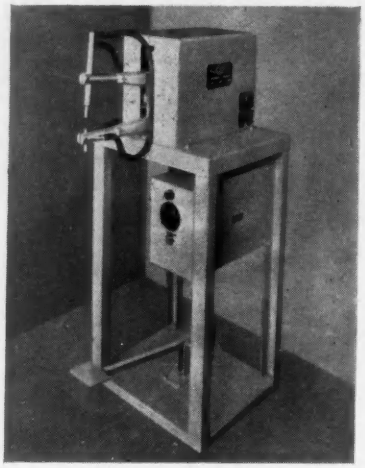
Feature of the models are the adjustable exhaust deflector sleeve, which can be rotated to blow exhaust air away in any direction and the detachable side handle which can be quickly adjusted to suit the particular drilling operation; the latter is available as standard on the ½ in. size only. Nevertheless, this attachment is obtainable as an extra on the smaller drill.

Decade Capacitor Box

A NEW decade capacitor box, which embodies an original type of 11-position switch claimed to afford a great saving in bulk and manufacturing costs, is being produced by WINSTONE ELECTRONICS LTD., Hampton Hill, Middx. Suitable for use in laboratory or test-room the instrument is light in weight, it weighs 2 lb, and should prove of value to electronic service engineers. The working range is ·001 mfd to 1·11 mfd in ·001 mfd steps and 500 V d.c. up to ·1 mfd and from there 350 V d.c.

Foot-operated Spot-welder

DESIGNED to meet the demand for a compact bench type machine capable of welding thicker materials than can be welded on a normal bench type spot-welder, the new "Meritus" P.S.8.B. foot operated spot-welder manufactured by MERITUS (BARNET) LTD., Wood St, Barnet, should meet with wide approval. Nominal output of the machine is 8 kVA and maximum continuous welding capacity is 2 x 16 s.w.g. mild steel sheet and 2 x ¼ in. diameter mild steel rod.



This machine is a notable addition to the "Meritus" range of welding machines

The welder is supplied complete with electronic weld timer, 4-position heat switch and water-cooling hose and is mounted on a steel stand to form a compact easily-transportable unit.

New Colour Corrected M.V. Lamp

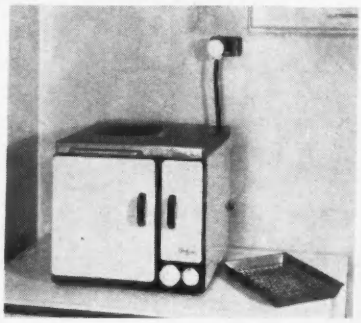
ONE of the highlights at the recent A.P.L.E. Conference exhibition was a new 400 W mercury vapour lamp having considerably improved colour rendering properties. Although 125 W mercury vapour lamps having this improved colour rendering have been available for some months, it is only now that a 400 W size has been manufactured. Known as type MVB/UF, the new lamp is particularly suitable, not only for public amenity lighting (such as seaside promenades, public squares and shopping centres) but for industrial lighting where a large number of women are employed, or where coloured materials are involved. As indicated by its designation, the lamp is a high pressure type, suitable for mounting in any position. It is, moreover, considerably smaller than equivalent 400 W uncorrected lamps, but in consequence fittings must allow for its higher operating temperature. The light source is enclosed in an outer glass envelope, the inner surface of which is coated with a fluorescent material giving an improved red light output. This lamp is available from Philips Electrical Ltd., Century House, Shaftesbury Ave, W.C.2.

Jackson Giant Re-introduced

SO many requests for the return of the "Giant" cooker have been received by THE JACKSON ELECTRIC STOVE CO., LTD., 143 Sloane St, S.W.1, that the company has decided to act on this. The Giant is returning and deliveries will commence approximately mid-November.

The specification of the cooker is as before. Its total loading is 2,600 W, oven thermostat and "Simmerstat" to radiant-plates are fitted as standard. Price—cooker only £18. 2s. 6d. Cooker complete with stand and saucepan shelf £19. 19s.

The "Giant" returning by popular demand



Coloured Telephones

NEW type coloured telephones to fit in with colour schemes and decor are now being marketed by COMMUNICATIONS SYSTEMS LTD., Strowger Hse, 8 Arundel St, W.C.2. These new telephones are available in red, ivory and jade green and are equipped with silver grey cords.

Price Reductions

PRICES of their single lamp "Perspex" fluorescent reflector fittings have been reduced to £8. 9s. (no p. tax) say BRITISH THOMSON-HOUSTON CO., LTD., Crown Hse, Aldwych, W.C.2. This covers both the F 1160 (open end) and F 1162 (closed end) models. Effective from 1 Sept.

HOTPOINT ELECTRIC APPLIANCE CO., LTD., Fletton, Peterborough, say that they have reduced the price of their Bowl Fire Model 30 which now costs £1. 15s. plus 12s. 10d. purchase tax.

TRADE PUBLICATIONS

CONDENSERS.—New leaflet issued by Dubilier Condenser Co., (1925) Ltd., is VC 13 Type "QM" and "QS" pre-set volume controls whilst leaflets VC 12, GR 754, R8, R5, MC 654, TPC 454, NC 654 and R7 have been issued in revised form.

POWER TRANSMISSION.—"Eetee Power fuses for operation in air" is a new descriptive pamphlet issued by Electric Transmission Ltd., Etruria, Stoke-on-Trent, Staffs.

FUSES.—New booklet issued by Dorman and Smith Ltd, Ordsal Electrical Works, Salford, Manchester 5, describe D. and S. high rupturing capacity Cartridge Fuses.

New Hotpoint Kettles

TWO new kettles are announced by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., Peterborough. They are the HK150, a 3 pt chromium-plated model, and HK160, a 4 pt chrome kettle.

Both are available for use on 200/210, 220, 230/240 and 250 V a.c. supplies and are rated at 1½ kW. In design they are generally similar to the earlier HK140, a 3 pt aluminium model, but the spout has been reshaped on up-to-date lines.

The Hotpoint type B kettle element is fitted to these kettles, the element having a safety cut-out mechanism to protect the element in the event of the kettle boiling dry. The body is made from a deep drawn copper pressing and has been chromium plated on the outside and nickel plated on the inside. The handle assembly is cool in service and the lid has two large steam vents, a black moulded knob, and a deep skirt to prevent it falling off.

Franco Fairy Folk

THE gay fiddler seen in the illustration is typical of FRANCO SIGNS latest, the "Fairy Folk" illuminated figures.

Made in three dimensional frames covered with waterproof plastic material in all colours these figures are illuminated from within by ordinary lamp bulbs. They range in size from 2 ft to about twice that size with some giant figures. They also create in this new medium the familiar characters used by National Advertisers as trade marks and symbols. Franco Signs Ltd., 15-17 King St, S.W.1.

For the Electrical Trade

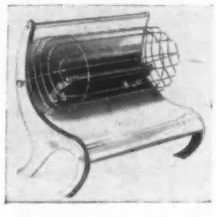
Carron Co Introductions

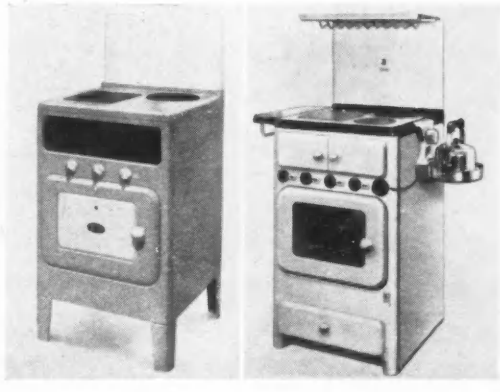
A REMARKABLE new cooker is one of three new introductions by the CARRON COMPANY, Carron, Falkirk. The "Cameo," as this cooker is named, embodies many interesting features.

It has a normal hob with grill boiler, 6¼ in. solid hotplate and 8 in. Simmerstat controlled radiant plate with large splash-back supporting folding plate rack. A hob extension with towel rail is fitted one side of the hob with a base resting type kettle holder and automatic cut-out attachment opposite. Beneath this is the grill chamber with two section spring hinged doors which by the use of one door only help conserve heat. The oven is fitted with a single tubular sheathed element positioned between a removable convector pad at the bottom of the oven. The oven wall is shaped to form five grid runners. The oven door has built-in glass panel. Bottom section of the cooker is the hot drawer heated by 500 W element. The cooker which has a total loading of 7,600 W is finished in cream with black hob or with green hob as alternative. Controls are mounted on the front of the cooker. All have a separate pilot light with a 13 amp kettle plug and switch alongside.

The other cooker, the L.2, is a model designed for simple hire or housing schemes and is a neat two-plate model finished in mottled grey enamel.

The "Curtsey" fire, L.2 cooker and Cameo cooker, extreme right, are new products from Carron. The fire is 1 Kw or 2 Kw, finished in holly green, cherry black, blue and gold, cream and gold, and mushroom





PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Phase Testing

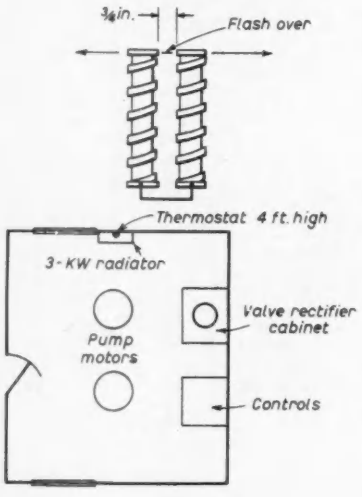
A RECENT note (3 June issue) emphasising the misleading results which can obtain from testing only between phase and earth brought to mind a similar experience some time ago. I was called to inspect a three-phase motor which merely hummed and remained stationary when the operator tried to start it. On examination, all three fuses in the nearby switch-fuse were intact, as were its switch contacts and supply connections. A pressure test at the switch-fuse showed no voltage between two phases of the incoming supply, although between each phase and earth normal readings were obtained. A similar picture resulted from a test at the service position, showing that the incoming supply was at fault. Other houses and premises, however, connected to the same source, continued to receive apparently normal single-phase supplies for lighting.

After making these investigations, I concluded, as only the three-phase supply had been affected, a short-circuit had occurred between phases in the main supply. The supply authority was notified accordingly and after the fault (located in an underground cable) had been repaired, the motor, originally reported as faulty, operated satisfactorily. This incident shows how important it is to test between phases, the only true test for a three-phase supply.—*J. H. Robinson.*

Damage to D.C. Armature

THE question of voltage surges occurring in d.c. circuits with the current supplied by a valve rectifier was discussed in these pages in the 3 Oct., 1953, issue. Another case occurred quite recently in a fully automatic pumping station fed by single phase with one valve rectifier supplying two vertically-mounted shunt interpole motors. One of the machines had a long history of trouble including damage to the commutator resulting, it was thought, from high micas, together with failure of the main contactor pull-in coil.

Below, the pumping station layout, showing remoteness of radiator from rectifier cabinet and right, the position of flash over across two armature resistance units



During a spell of very cold weather the armature developed a fault to earth in the middle of a slot and about 2 in. of stampings and coil were burnt away. The motor was stripped for re-winding and it was soon discovered that other coils in the armature had been similarly damaged to a lesser extent and previously repaired. Associated with this latest trouble was a flash over, which occurred between two units of armature resistance (see diagram) spaced about ¾ in. apart. Such a fault would lead to the suspicion that a loose nut had dropped between the resistance elements, but careful search eliminated this possibility.

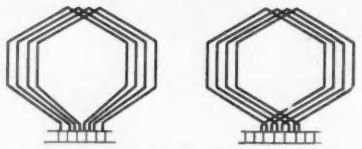
As everything pointed to a voltage surge the rectifier makers were notified and a technician visited the site and found that the failure occurred during a particularly cold spell. Although the building was thermostatically heated the valve cabinet was far too cold for satisfactory operation of the rectifier. Moreover the heater, a 3 kW radiator, was remote from the valve and the thermostat was mounted 3 in. above the heater, as shown in the sketch. It was also observed that the surge suppressor fitted was of an obsolete design and inefficient. By accident the fuses fitted to the contactor control circuit were for 400 V a.c. and not d.c. working (they happened to be quite satisfactory on this station but an identical station in another part of the town had had trouble with these fuses exploding with violence and smashing the glass door of the cabinet). Finally, the negative d.c. tube was earthed. Resulting from the visit, it was recommended that a heater grid of "Pyrotenax" type be mounted between the valve and the cooling fan below, with a thermostat fitted in the valve cubicle. New suppressors were also advised, together with the negative being made earth free, whilst discharge resistances were to be fitted across the pump ends of the shunt circuit inside the motors.

To quote the technical representative in effect, "the valve struck in spite of the cold weather but the current was pulsating and the rectifier transformer generated a voltage surge." He also added a most useful remark that a valve was like a human being, disliking excessive heat and cold rooms.—*K. W.*

Progressive or Retrogressive?

THE rewound armature of a d.c. shunt machine, after the routine tests, was fitted inside its shell. When the machine was run it did not build up voltage. The armature was again tested for short between segments, between turns and insulation to ground and no defect was observed, as was the case on testing field coils and connections. To eliminate all doubts another good armature was fitted, and when run the machine built up voltage correctly.

Feeling completely at a loss, the rewound armature was again fitted up, and this time, it was run as a separately excited machine. It built up voltage but with the wrong polarity. The winding was lap, with four coil sides/slot. The winder had done similar jobs a number of times before and there was no mistake in either the coil or commutator pitch.



In diagram (a), left, is seen the correctly wound progressive winding and (b) the incorrect retrogressive winding

Finally, it was observed that the connections to the commutator segments, instead of being made to give a progressive winding, as in (*a*) in the diagram, were made to give a retrogressive winding, as in (*b*).

Such a mistake, even though it looks so awkward on paper, can be very easily made. The winder finds it convenient, first, to make all the bottom connections and then all the top connections. If, after completing all the bottom connections, and about to make the first top connection, he gets involved with clockwise and anti-clockwise directions, and makes it wrongly, then as a matter of routine, all the top connections will be wrong, and the machine will build up voltage with the wrong polarity. When the top connections were all removed and reconnected as shown in (*a*), the machine then built up voltage with the correct polarity.—*T. V. S.*

NEWS OF THE WEEK

Wholesale Values for Purchase Tax Charging

New Method of Determining Values from 1st January, 1955

NEW provisions determining the wholesale value of goods for the purpose of charging purchase tax, are to come into effect from 1 Jan. next. Notice No. 79 just issued by the Commissioners of Customs and Excise sets out the new modifications, chief of which relates to sales from manufacturer direct to retailer. At present the value of p.t. is computed at the price which would be paid to a wholesaler. Under these new statutory provisions, on sales to retailers, the price charged by manufacturers or wholesalers who sell mainly to such traders will be accepted as the tax value, provided that the parties are independent. In many cases, especially for branded goods, the standard list price to retailers, before deduction of any quantity discount, will provide the tax value. But in no case should the tax be computed on less than the actual net price paid by a retailer, except with official approval.

In regard to sales to large buyers, where the same goods are also sold to ordinary retailers and the price charged to those retailers has been accepted on the tax value, that same value may also be applied. In other cases it will usually be necessary to make an appropriate addition to the invoiced price to bring it to the retailer price level. The amount of the addition will depend on the circumstances, but the standard percentage figures agreed with the Trade Associations for most classes of goods will normally be applicable.

Where goods are sold to buyers who are wholly or partly under the same financial or managerial control as the seller, or where they are transferred to branches forming part of the suppliers' business, p.t. must be assessed on the price paid by ordinary retailers buying in the open market from independent suppliers.

Where goods are sold to a trader at a gross price which is subject to a discount for cash, the tax value may be taken as the net cash price, notwithstanding that the buyer may forfeit the discount by delay in settlement. But the cash discount must be fully operative to all buyers. Where the cash discount requires a minimum quantity to be purchased, the discount may be allowed only if the prescribed minimum quantity is within the limits normally purchased by retailers generally.

Delivery costs to the buyers' premises are included in the wholesale value on which p.t. is chargeable, and if goods are sold on carriage forward terms an appropriate adjustment for delivery cost must be made in calculating tax. Where this is not known or not readily ascertainable an average or percentage figure (normally not less than 2½%) may be applied. It will be recalled that a relaxation in regard to extra delivery charges was introduced a year ago.

E.T.U. Dismissal Starts Dock Strike

REPERCUSSIONS immediately followed last week when five E.T.U. members employed in a London ship repair yard were dismissed. It was argued by the Union that the men were discharged against the "last-in, first-out" principle. Other E.T.U. members on similar work went on strike and have since been joined by many members of the Amalgamated Engineering Union. According to a spokesman of the E.T.U., about 2,000 men from other unions had joined in supporting the 500 E.T.U. members officially on strike by last week end, and there was likelihood of a further extension of the dispute. Meanwhile representatives of the employers and the unions have had meetings in an effort to reach a settlement.

Rise for Plumber-Jointers

AN increase in pay for plumber-jointers and their mates, is announced, to operate from the first full pay period following 23 Sept. Plumber-jointers are to get 1d. an hour more, making their rate 4s. 1½d. an hour in the London area and 3s. 9½d. elsewhere. For plumber-jointers' mates the rates will be 3s. 5¼d. and 3s. 2¼d. an hour respectively. There are consequential increases in pay for learners and other grades in the scope of the plumber-jointers' agreement.

FINANCING WORLD ELECTRICITY

LOANS for purchases in the electric power field are the largest item in the analysis of lendings to date of the International Bank for Reconstruction and Development, made in the Bank's ninth annual report. Out of a total of $1,874 millions of loans negotiated up to 30 June last, $509 millions are listed against electric power: the equivalent of £184 millions. The amounts, in millions of dollars attributable on a continental basis are as follows: Asia and Middle East, 63; Africa, 88; Australasia, 33; Europe, 35; Western Hemisphere, 290. During the year ended 30 June, 1954, which is reviewed in the present report, a total of $107 millions were lent for electric power purposes in Japan, South Africa, Brazil and Nicaragua.

In addition, a total of $397 millions has been loaned for transport, including a considerable sum for railways. For instance, in 1953-54, there were loans in connection with railway projects in Brazil, French West Africa, and South Africa.

It will be recalled that the working of the Bank was described by Mr J. R. Beard in his Presidential Address to the British Electrical Power Convention this year. He suggested that there was a deficiency of British experts on the staff of the Bank, largely as a result of lack of British interest. However, he thought this was being overcome.

F.B.I. on Technical Colleges

CONCLUSIONS reached at a conference on technical colleges and industry organised by the Federation of British Industries are summarised in a report of the conference issued last week, by the Federation (price 4s. 6d.). The conference was held during May last, and the seven papers presented, together with the discussions on them, are reproduced in the report. There was general agreement that short of drastic revisions, for which there are some strong arguments, few changes could be made with advantage in the present administrative system for technical education in England and Wales. It was found, however, that the functions of the technical colleges are not, in general, fully understood. In particular, it is not always appreciated that the colleges work at three main levels—craft, technical and technological. Grammar schools have never fully understood the opportunities offered by technical colleges.

There is believed to be an urgent need to transfer able technical college students from part-time to full-time courses, and a sandwich course for each technology has been suggested: however, critical examination of the whole idea of sandwich courses is needed first. In all such developments, however, it is essential not to overlook the fact that there are vastly more students at technical than at technological level. Over all, there is need for closer co-operation between technical colleges and industry on a local basis.

Commercial Training for Atomic Power Utilisation

£250 Three Month Course on Conversion of Heat from Piles into Power

ANTICIPATING the industrial and commercial utilisation of atomic energy, the United Kingdom Atomic Energy Authority is opening a reactor school at Harwell. For a fee of £250 it will provide a three month course of training for staff from industrial concerns to learn the techniques by which heat developed in atomic piles may be converted into power. The fee does not include hotel accommodation.

About 25 students can be accommodated in the course, and three courses will be held each year starting in September, January and May. The syllabus includes lectures and individual instruction in nuclear physics, reactor physics, metallurgy and reactor engineering, as well as experimental work.

Applications for places should be made to the Manager, Reactor School, A.E.R.E., Harwell, Berkshire, and should give sufficient information to allow judgment to be made of the applicant's academic standard.

Speaking at the beginning of the first course, to the 33 enrolled trainees, Sir John Cockroft said that he thought it possible to build between 1965 and 1970, nuclear power stations which would do the job of 20m tons of coal per year. He envisaged a development period of eight years during which the first two atomic power stations would be operated. New types of unit would then follow.

A.S.E.E. OUT OF SPACE

Mr Thorogood, General Manager of the A.S.E.E. Exhibition, due to heavy demands for space, has had to close down after the short period of three weeks, all further applications for the 1955 (Mar. 15-19) Exhibition. The whole of the Ground Floor, at Earl's Court, has been allocated, representing 250,000 sq ft, and it is now suggested that as far as the 1956 Exhibition is concerned restrictions may be made on the size of stand and a ballot drawn for positions.

If, however, demands for space are maintained it may be necessary for the first floor of the Hall to be utilised as well.

Midland Rural Electrification Slow?

SOME hard words were said at the meeting of the Midlands Electricity Consultative Council, when Mr H. Goodwin of Leek alleged that the Board needed "stirring-up" about rural electrification in the area north of Leek. This was refuted by Mr Walter S. Lewis, chairman of the Board, who emphasised that it was essential for the Board to have a planned policy. In the past six years, he said, nearly 8,000 additional farms in the Midlands had been connected, and in the same period 290,000 new consumers had been added. In the year ended last July the number of new consumers had been a record 52,670 including 1,336 farms in the area. More than £36 m had been spent in capital expenditure and this year the Board expected a capital expenditure of more than £6·5 m.

Mr Lewis was supported by Ald D. W. Hamlen-Williams who said that the rural areas had had a "very fair crack of the whip from the M.E.B."

Below is shown the new "Regina" banqueting hall, capable of seating over 600 guests, at the Piccadilly Hotel, London. Lighting is provided by a series of specially designed Ediswan fixtures, each consisting of a cast brass back plate supporting a heavy spun vase, and an 18 in. dia. self-coloured amber glass bowl enriched with embossed crystal diamond chipped lines and with a special glass diffuser fitted inside. The Ediswan scheme comprises 46 fittings and they were installed by the electrical engineers of the Piccadilly Hotel

OFFICIAL PUBLICATIONS

BRITISH ELECTRICITY AUTHORITY. Report of the authority for the year 1953-1954. H.M.S.O. 9s.

B.E.A. AREA BOARDS' REPORTS. Reports of the various Area Electricity Boards obtainable from H.M.S.O. at prices stated. London, Southern, N.E., 1s. 6d.; S.E. Scotland, 1s. 9d.; South Eastern, South Western, Midlands, S. Wales, Yorks, N.W., S.W. Scotland, 2s.; Eastern, E. Midlands, Mersey and N. Wales, 2s. 6d.

PURCHASE TAX. Determination of Wholesale Value. Notice No. 79, issued by H.M. Customs and Excise. (See page 493).

HEAVY EQUIPMENT FOR POWER STATIONS. Deliveries and Orders on 1 April, 1954. Produced by the Organisation for European Economic Co-operation. H.M.S.O.

STANDARDS. Annual Report 1953-4 of the British Standards Institution. Available from British Standards House, 2 Park St, London, W.1. 5s.

E.R.A. REPORTS.

C/T111, The Economic Value of Hydrogen Produced by Wind Power, by A. H. Stodhart, 9s. 3d. C/T112, The Use of Wind Power in Denmark, by E. W. Golding and A. H. Stodhart, 15s. 3d. (See page 469).

A.E.I. Acquire Birlec

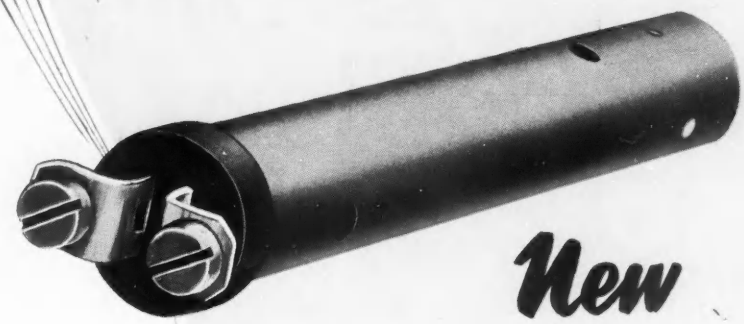
THE Mond Nickel Co., Ltd., has announced that following negotiations between Associated Electrical Industries Ltd., Mond and Birlec Ltd., the sale by Mond of its wholly-owned subsidiary, Birlec Ltd., to A.E.I. has been agreed. Birlec will operate as an individual company within the A.E.I. Group. Mr George P. Tinker will continue as managing director and Mr T. G. Tanner and Mr J. H. Crossley as executive directors.

POST OFFICE RESEARCH

EXPERIMENTAL work in most fields of telecommunications was on view at the Dollis Hill G.P.O. laboratories last week. Advances in connection with the transatlantic telephone cable were shown in a series of demonstrations. One of the striking features of the repeaters, which are to be inserted in this cable is the gold plating of the chassis to prevent crystalline tin projections growing and making unwanted connections. The repeater circuits are so designed that any individual component may be shorted-out without serious effect on performance. A 2,000 V d.c. power supply at 0·3 amp will be provided along the cable. Where the polythene insulated cable is brought into the repeater, a steel gland is employed which is bonded to a layer of polythene, which is in turn united with the cable sheath by additional polythene.

Amongst the wide range of other work on view was a 99 line experimental electronic telephone exchange, which is being used as part of the research station's internal telephone service, and a valveless amplifier using barium Titanate capacitors having non-linear properties. It is energised by power at 100 kc/s and amplifies in the audio-frequency range.

PROGRESS IN CONTROL



New

WATER HEATER THERMOSTAT

at half the price!

For many years the name Sunvic has meant dependable thermostatic control of electric water heaters. Now a new model, type TQB, whilst maintaining the same standard, is at the same time more compact and costs half the price. It is an immersed, withdrawable type and its performance complies with BS. 1555.

The only available thermostat conforming to present trends, its introduction marks an important advance in thermostat design.

One more example of the continuous development of *CONTROL*

EQUIPMENT BY SUNVIC

SUNVIC CONTROLS LTD. (Domestic Division), No. 1 Factory, Eastern Industrial Estate, HARLOW, ESSEX. *Tel.: Harlow 24231/5.*

Manufacturers of the Simmerstat, Oven Thermostats, Radiant Hotplates and Pneumatic and Electrical Instruments for detection, measurement, control and recording of Temperature, Flow, Liquid Level, Specific Gravity, and Pressure, in Science and Industry. Vacuum Pumping and Measuring Equipment, etc.

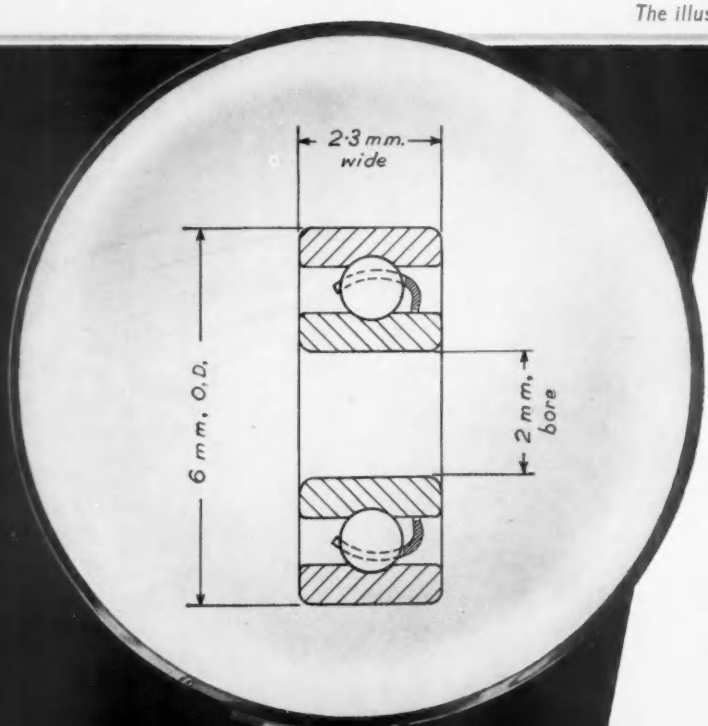
Member of the A.E.I. Group of Companies.

TAS/Sc.D.282

Miniature bearings

TO ANY SIZE AND SPECIFICATION

The illustration shows a typical example



FBC TRADE MARK

ALL-BRITISH
BALL AND PARALLEL-ROLLER BEARINGS

F.B.C. :: FISCHER

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WOLVERHAMPTON.

Fischer Bearings Company Ltd., and Timken-Fischer Stockists Ltd., Birmingham, are both subsidiaries of British Timken Ltd.

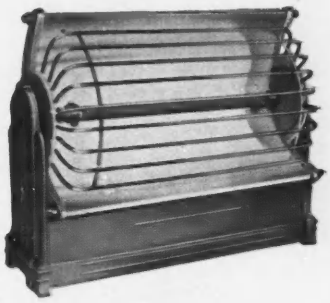
It's **MEM** again for top value in fires and convectors

QUALITY is better than ever in the new season's MEM range. All reflectors are brass, heavily chromium plated. Every fire and convector complies fully with BS 1670. This lays down stringent requirements for insulation, safety clearances, earthing and rust-proofing, thus ensuring complete safety, long life and reliability. You can offer this extra quality in all MEM fires at prices that mean quick, easy sales.

MEM fires are available in a choice of attractive colour finishes.

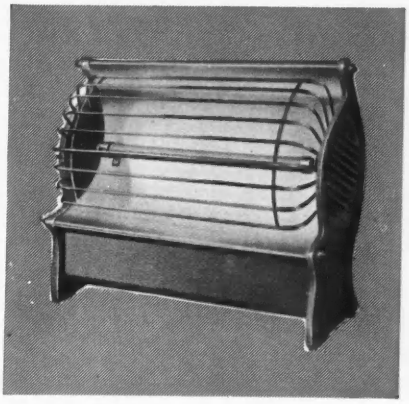
Each fire has a substantial safety guard complying with statutory safety regulations.

Send for new Fire List No 351.



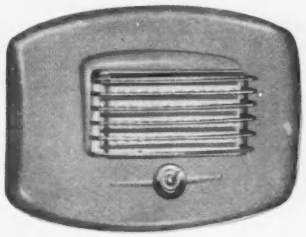
MEMRAY

Fine quality swivel reflector fire. Chromium plated brass reflector, efficient guard, robust cast construction. In 1 and 2 kW ratings.



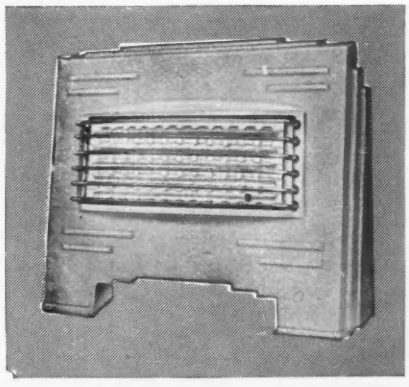
REFLEX

A sturdily built reflector fire offered at an attractive price. Cast iron sides, chromium plated brass reflector. In 1 and 2 kW ratings.



PANEL FIRES

Attractive modern designs. The "Walbeam" Outset Flat Bar Pattern is designed for surface mounting. The "Walray" Inset Reflector Pattern is for recessing into wall or surround.



MAYFAIR

A really well-made bar type fire that will give years of good service. Attractive simple design. Sturdy cast frame. In 1 and 2 kW ratings.

MEMVAIR CONVECTORS. Keep in step with the growing popularity of convectors by giving a prominent place in your showroom to MEMVAIR convectors. Handsome, efficient and absolutely safe. Lovely bronze finish. In three ratings, 1, 1½ and 2 kW with or without thermostat.

MEM MIDLAND ELECTRIC MANUFACTURING CO. LTD., Tyseley, Birmingham 11.

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The sparkling array of Fine-Quality appliances at prices to suit everyone's pocket. When you buy Premier appliances you are always assured of the well-known Fine-Quality.

Send your Orders now and be sure of early delivery. Our latest booklet awaits your postcard.

every one will want

PREMIER

ELECTRIC APPLIANCES

PREMIER ELECTRIC HEATERS LTD · BIRMINGHAM 9 · ENGLAND

A member of the A.E.I. Group of Companies

The Mayor switches "on" at Sale

SALE SUBSTATION OPENED

DUE to the remarkable growth in load in the Sale area of North Cheshire, it became necessary to reinforce the North Western Electricity Board's 33 kV system. A new substation housing two 132/33 kV 45 MVA transformers with associated switchgear has now been opened, and was formally switched on by the Mayor of Sale, Coun L. Bethell, in the presence of Sir Joseph Hallsworth, Chairman of the Board, and other representatives.

Supply to the substation comes from nearby Carrington station or from the 132 kV Grid system. At Carrington the substation will eventually be connected directly to the 275 kV supergrid. Control of the substation will be from the Board's No. 1 sub-area central control in Manchester.

NEW ASSOCIATESHIP AWARD CREATED

A NEW award, Associateship of the Liverpool College of Technology (A.COLL. TECH.LIVERPOOL) has now been established. This will be awarded only to students whose educational standard is at the level required to comply with the regulations for corporate membership of certain professional Institutions. In general the minimum period of attendance required is the final three years of an approved course. Students however, enrolling from other Technical Colleges may be considered for the Award, but in no case will attendance at Liverpool of less than three years part-time or two years full-time be considered satisfactory. The Award will become operative as from Sept. 1954, and students who obtain appropriate qualifications prior to the Session 1953/54 cannot be considered. Students who complete Advanced Part-time Day or Evening Courses up to, and including one year beyond Higher National Certificate may be considered, provided that the additional one year Course includes at least one technological subject approved for Endorsement of the H.N.C., or in certain cases at least one subject of appropriate standard required for a post-H.N.C. professional qualification, and of course, provided they pass the examination(s) associated with the additional year of study.

The First Half-Century

Negotiations between the Danish Government and the Great Northern Telegraph Co., for the laying of a telegraph cable to Iceland have at last resulted in agreement. In the earliest days of submarine work when the first Atlantic cable had failed there was serious talk of getting to America via Iceland. As soon, however, as the difficulty of the Atlantic cable was surmounted the chance of Iceland getting into telegraphic communication with the rest of the world disappeared until it was revived by the desire of the Danish Government to be in a position to know what was happening in this portion of its domains. The new cable will start from Shetland and it is to be completed in two years.—*From our issue of 29 September,* 1904.

E.T.U. Member Fined

BECAUSE he was one of a group of maintenance electricians who broke a three-month strike among employees of J. Lyons and Co. last August, a member of the Electrical Trades Union, Mr W. Knowles, is to be fined £5 if the recommendation of the Acton branch of the Union is approved by its National Executive Committee. Mr Knowles, who has been a member of the E.T.U. for 30 years, was accused of bringing discredit on the Union by returning to work against its orders, it is stated. It will be recalled that the Union recommended all the strikers to return to work early last August because they thought no useful purpose would be served by continuing the strike; attempts would be made to settle in other ways the dispute over the employment of a non-Union supervisor.

Lunchtime Cookery Demonstrations

FOLLOWING the success of the Food Fair, the Electrical Development Association in conjunction with the London Electricity Board and *Woman*, arranged a series of lunch-time demonstrations of electric cooking at the Regent St Showrooms. These closed last Friday. The L.E.B. demonstrator, Miss Mary Barnard used a Creda E.V. 13-3 plate cooker, and an English Electric automatic cooker was used on several occasions. Other equipment included a G.E.C. refrigerator and a Kenwood electric mixer. An electric travelling iron was presented to each of the film and radio stars who attended each day.

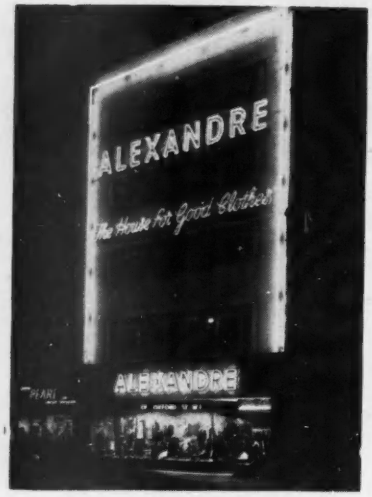
Persuading the Farmer

A PLEA for further liaison between all parties interested in farming and farm electrification was made by Mr R. A. Bayetto, rural electrification officer of E.D.A., when he addressed 60 members of the staffs of the Midlands, South Wales and South Western Electricity Boards attending a course on rural electrification. He stressed the importance of not overlooking those who had not yet a supply of electricity. At the same time, many connected farms were still not using electrical power to fullest advantage, and it was the small farms, which possessed the greatest labour problems which made the least proportionate use.

More Belfast Contracts Placed

IT is announced that the contracts for the second extension of Belfast Power Station (West) have now been placed. This second extension will consist of one 60 MW turbo-alternator to be provided by C. A. Parsons Ltd., at a cost of about £738,000; two 220 klb/hr boilers from Mitchell Engineering Ltd., at an approximate cost of £704,000 and the main excavation and piling will be by Stewart and Partners, Belfast, at a cost of around £36,000. With this extension, the capacity of the station will be 240 MW making it the largest steam generating station in Ireland.

It may be recalled by readers that the boiler tendering at this station gave rise to an intense and violent controversy as to the procedure to be adopted. Alderman W. Cecil M'Kee, who initiated the controversy, is reported as saying, in connection with these latest extensions, "In consideration of getting the contract for these two boilers Mitchell Engineering have reduced their price for the four boilers already placed by £75,000. This represents a total saving, including consultants' fees, as a result of the contracts being advertised, of more than £400,000 on the original tenders."



Prominent in Oxford St is the above sign produced by Franco British Electrical Co. The facia section is in 2 ft 6 in. stepped section letters which illuminate the outline in rose-pink. The name "Alexandre" at the top is in 3 ft 6 in. letters, illuminated by superimposed primrose yellow tubing, the same colour being used for the words "The House for Good Clothes." Outlining the building is rose-pink tubing

Hoover Week Builds Up

ANNOUNCED in the current issue of "Hoovergrams," the dealer house magazine, are details of the special advertising arrangements being made by Hoover Ltd., in connection with "National Hoover Week." These include, apart from national advertising by the company itself, special display material, the normal two-day loan offer, and dealer tie-up advertising material. There are 159 prizes to be allocated in the Window Display Contest. The campaign runs from Oct. 2 to 9.

Cathodic Protection of Sheet Steel Piling

A REPORT has recently been submitted to the Tyne Improvement Commission showing that the cathodic protection of steel sheet piling on various Commission properties is proving successful. It is understood that since the system of protecting steel piling by means of the cathodic system was introduced, no measurable corrosion has taken place. At the Tyne Plywood Quay, at the present rate of corrosion, it will be 72 years before any remedial measures are needed, and the steel piling at Howdon Staith will not need attention for the next 20 years.

North-Eastern Trading Estates, Ltd., are to install a similar system of protection at Burndept Quay, South Shields. Cables will be laid in a trench in the river bed and connected to six graphite electrodes placed in a line parallel with the quay at 7 ft centres and about 120 ft from the quay frontage.

E.I.B.A. Steady Progress described at A.G.M.

1770 Members receive helping hand during year

SPEAKING at the annual general meeting of the Electrical Industries Benevolent Association, Sir John Dalton, President of the Association, emphasised the need for more full members. He did not think that any section of the industry was providing as much as it could or as much as it should to the E.I.B.A.

Mr Deacon, Chairman of the Court, said that the year had been one of steady progress and that a total of 1,770 members had had a helping hand when they needed it most. The increase in the Association's work over the year had been markedly taking place among cases which did not finally make demands on the Association for direct money grants. This was a good sign as by the Association's early intervention in these cases, problems were being solved before they became complicated and acute, and a breakdown later with the need for considerable financial aid was avoided. Mr A. E. Page, Chairman of the Finance Committee, said that the E.I.B.A. was making progress fast and yet surely. The sound position of the Association was due to the vigour with which the branch officers, and other people, worked on its behalf. There was, however, no room for complacency.

The following were newly appointed as members of the Council: Mr H. Bishop, Mr J. Eccles, Mr R. E. V. Ely, Mr D. G. Lindsay, Mr F. Long, Mr A. E. Page, Mr J. H. Scott, Mr J. Smellie and Mr A. H. Young. Mr H. A. Deacon was re-appointed Chairman of the Court and Mr R. E. V. Ely was elected an additional member. Mr C. R. King was elected a member of the General Purposes Committee, and Mr J. Mortimer Hawkins was elected to the Finance Committee.

Mr Hamlyn Drake proposed a vote of thanks to the Institution of Electrical Engineers for the use of their Council Room for the meeting, which was attended by members from as far away as Edinburgh.

The Association is holding its Annual Ball, as usual, on the second Friday in November, which this year is the 12th of the month. The rendezvous is again the Great Room at Grosvenor House, Park Lane. Eric Robinson's orchestra will play for the dancing and there will be a midnight entertainment. Tickets at 2½ guineas each can now be obtained from the Association at 32 Old Burlington St, W.1.

TV FOR S. DEVON

IT IS hoped to start work immediately on the construction of the new permanent and VHF transmitting station at North Hessary Tor in Devon. This was the intention of the B.B.C. following receipt of the Minister of Agriculture's consent. The television station, which will include a 750 ft mast should be completed by the end of 1955, and the VHF station during the following year.

Selling Begins in Works

ACTING on the principle that selling begins at home, the Revo Electric Co., Ltd., have recently completed a well-equipped demonstration theatre at their Tipton factory. This is designed to seat 72 persons, and is fitted with a demonstration stage at one end, complete with a sink-unit and built-in kitchen equipment. A demonstration and preparation table are also included. The theatre is illuminated by concealed lighting.

Numerous demonstrations have already been given to visiting parties comprising the staffs of Area Electricity Boards, Towns' Women's Guilds, Women's Institutes and other interested bodies. The company is always pleased to arrange for parties to visit the works, when interesting tours are arranged followed by demonstrations where applicable.

Labour Costs Deter Potential Users

MANY people cannot afford the electrical facilities they need because of the high cost of installation labour. This was emphasised by the new chairman of the Ipswich and District Electrical Association (Mr H. E. Wright) speaking at the opening of the 21st session of the Association. He also maintained that it was up to the employer to give his operatives a fair, and even generous reward for the services they rendered, but in return the operatives should give of their best. The introduction of an incentive scheme was an admission that the personnel in the industry concerned were not giving of their best. In many instances intensive propaganda had conditioned the operative's mind against the team spirit, and his thoughts and actions were directed toward the prevention of "exploitation."

Mr C. T. Melling, president of the Association, occupied the chair at the meeting and a vote of thanks to the speaker was moved by Mr P. Sydney.

Power Systems Communication Course

AN advanced course on Power System Communications is to be held at the Heriot-Watt College, Chambers St, Edinburgh, beginning on Oct. 23. The syllabus covers methods of signalling, types of equipment used, circuits and amplifiers, post office equipment, carrier-current techniques, radio and television, remote control, telemetering and system control indication. Lecturers include M. D. Kippen, B.SC., A.M.I.E.E., of the S. E. Scotland Electricity Board; D. H. Miller, B.SC., A.M.I.E.E., Ferranti Ltd.; Prof M. G. Say PH.D., M.SC., M.I.E.E., of the Heriot-Watt College; S. J. Little, A.M.I.E.E., P. O. Engineering Dept, London; S. A. Soutter, B.SC., A.M.I.E.E., S.E. Scotland Electricity Board; C. Gordon White, B.SC., A.R.C.SC.I., Standard Telephones and Cables, and F. B. Willis, G.E.C., Coventry.

NEWS IN BRIEF

The next International Machine Tool Exhibition to be organised by the Machine Tool Trades Association will be held in 1956 from June 15 to June 29 inclusive at Olympia, London. This will be the major tool exhibition of the year as, following an understanding with the European Committee for the Co-operation of the Machine Tool Industries, no other international machine tool exhibition will be held in 1956.

The B.B.C. has introduced a revised version of the morning T.V. demonstration film. Transmissions start at 10 a.m.

The progress report of the British Productivity Council for the period 1953-54 has just been issued.

Some farmers were refusing the Electricity Board permission to take poles over their land until they were assured of a supply of electricity themselves, it was stated at a Nantwich (Cheshire) R.D.C. meeting.

N.C.B. University scholarships in mining engineering and allied subjects have been offered this year to 30 young men in the industry and 45 outside. 69 were awarded last year.

Thermovent Electric Space Heaters were exhibited by E. K. Cole at the Rochester Room, Queen's Hotel, Leeds, last Monday and Tuesday.

The "Nichols-Moore Bowl," together with a tankard, was won in the Finals of the E.I.B.A. South Wales Area Golf Competition, by Mr E. C. Batchelor, Senior Assistant Engineer, Generation, B.E.A. South Wales Division. Prizes were presented by Mr. L. Howles, Chairman of the South Wales Branch of the E.I.B.A.

Sayings OF THE WEEK

"No important complicated invention is commercially produced only as the result of one man's momentary brainwave. Inventions are now the result of teamwork and leadership and so often require enormous sums for the final development to a commercial stage." . . . SIR HENRY PILKINGTON, speaking to the Southern Region of the F.B.I. at Reading.

"It is not too much to expect that our children will enjoy in their homes electrical energy too cheap to meter." . . . MR LEWIS STRAUSS, chairman of the U.S. Atomic Energy Commission, speaking in New York.

"If these (monopoly) Commissions considered themselves called upon to determine for every line in the electrical industry what constitutes a so-called 'reasonable profit' they would make it impossible for the industry—constantly adventuring into new and unexplored fields—to do justice to itself." . . . SIR HARRY RAILING, chairman and joint managing director of the General Electric Co., declared last Thursday.

ELECTRIC SUPPLY NEWS

Belfast

For the year ended 31 Mar. last, the revenue from the sale of electricity, and from hire of appliances, etc., of the City Electricity Department amounted to £2,464,969, and the net surplus is £129,970, it is shown in the report of Mr R. P. Watson, city electrical engineer and general manager. Units sold in the Corporation's area of supply totalled 395·3 millions—an increase of 5·65%. Consumption for lighting alone was 13·79% up, and on the domestic rate 2% higher, but supplies for general power were 14·13% above the previous year's figure. A further 4,737 consumers were connected, making that total 135,679 at the end of Mar. On the distribution side, 18½ miles of h.t. cables, 21¼ miles of l.t. cables and 20 miles of service cables, together with 14¼ miles of o.h. line were added to the system. The extension and development of the 33 kV cable network including interconnection with power station West, is proceeding satisfactorily, and the installation of the 110 kV interconnector between the latter station and Donegall distribution station was commenced. Some 264,248 tons of coal were consumed at the two power stations during the year, at an average of 1·333 lb of coal per unit generated.

Crediton

The Rural Council has reversed its earlier decision opposing the South Western Electricity Board's rural development contributions scheme, and has now decided to support the scheme in principle. At the recent meeting of the R.D.C., however, no indication was given whether the Council would pay the contributions for council houses or the tenants themselves would have to pay. One council member, Mr D. J. Densham, said he thought the scheme was unfair in that tenants who lived in a district with mains paid no contributions, whereas those who lived away from the mains would have to. He intimated that at the next meeting of the Housing Committee he would propose that the Council should pay the contributions and adjust the matter in the rents of the houses concerned. Another member suggested that it should be left to the tenants to pay and to decide whether or not to have their houses connected.

Guildford

The South Eastern Electricity Board has put into operation its new substation at the rear of the electricity works in Woodbridge Rd, Guildford. This new substation has become necessary to meet the increasing demand in the area. Its cost is put at £120,000. Since 1948, about 5,000 have been connected to the mains in the area. About 3,300 cookers and 1,600 water heaters have been installed. Many farms have also been connected.

Taunton

A new major supply point which has been built at Fideoak, Bishops Hall, near Taunton, to tap the 132 kV grid line and supply electricity to Taunton, Wellington and Wivelscombe areas, was visited by Mr S. F. Steward, chairman of the South Western Electricity Board last Thursday. This new supply point, built jointly by the B.E.A. and the Board, is designed to meet the increasing demand in the area. It will also be one of the points at which power from the new East Yelland generating station will feed into the National Grid. The South Western Electricity Board's switching station on the site, was constructed at a cost of nearly £200,000. A new control room is being built at the old St James St power station, Taunton, which will ultimately control supplies over an area of about 1,800 sq miles. Already three main cables have been laid from the new supply point into the old power station site and a new o.h. line has been erected to connect through to Wivelscombe. A further line will shortly reinforce the supply to Wellington.

Whitby

Complaints of irregular supply voltages in the Esk Valley were voiced at a recent meeting of Whitby Rural Council. A Councillor said that a voltage graph, taken at one house in the village, looked like a contour map of the Himalayas. Councillor K. Levack, of Goathland, asserted that the frequent breakdowns were a nuisance to the hotel trade, particularly because repairs were invariably carried out at weekends, the explanation being given that industrial enterprises had to be considered first. It was decided to refer the matter to the North Eastern Electricity Board.

LIGHTING SCHEMES

Middlesbrough. The watch committee have recommended street lighting schemes, costing nearly £11,000. Gas lighting in Cargo Fleet Lane from South Bank Rd to Ruth Ave is to be replaced by sodium lamps with concrete columns at a cost of £5,230. Improved lighting is planned also for South Bank Rd at a cost of £2,010 and smaller amounts are to be spent in other parts of the town.

Rutherglen. The T.C. has approved the conversion of street lighting from gas to electricity. The work is to be carried out in three stages, at an estimated annual cost of £10,000.

Stanley. The M.o.T. has told the U.D.C. that it must provide class "A" lighting for the main Bradford Rd, or the Ministry will do the work and charge the Council.

COMPANY ACTIVITIES

THE price of copper has risen another £20 since my remarks last week. And in his annual speech to shareholders of General Electric, Sir Harry Railing said a good deal about costs in relation to overseas competition. At the time, he was more concerned about wages and taxation. Should copper continue to rise or remain high, obviously that is going to be another factor to be taken into consideration. In speaking of costs, Sir Harry was mainly dealing with the growth of foreign competition in overseas markets. The effect to date has been to reduce the demand for capital goods. Sir Harry's main argument was that competitors pay lower wages and less taxation. He says it is essential that the cost structure should not be inflated further, espcially as many of the products contain a labour cost element as high as 80% of the total costs In the past it has been possible largely to absorb excessive increase in costs by excessive turnover and greater productivity. But, according to Sir Harry, the heavy level of taxation limits the extent to which the industry can finance its expansion out of profits and puts manufacturers at a competitive disadvantage with overseas manufacturers. In the home market the outlook is good, apart from the new question of the price of copper. There are ample orders for capital goods and consumer goods.

An interesting development was the announcement last week that British Insulated Callender's Cables Ltd. is to help the £30 million Roan Antelope Copper Mines to finance its proposed new electrolytic refinery at Ndola in Northern Rhodesia. British Insulated and Roan Antelope are old friends, in as much as B.I.C.C. takes its copper requirements from Roan and discusses matters of common interest. But this is the first time that B.I.C.C. has entered into a financial operation of this magnitude. It is estimated that £3 millions will be required. It is to be provided as to two-thirds by Roan and one-third by B.I.C.C.

The refinery will have an initial capacity of 55,000 to 60,000 tons of electrolytic copper per annum and production is expected to start in 1958. The design will allow for a possible eventual expansion to 110,000 tons a year, at an estimated additional cost of £1·25 millions.—*From our City Correspondent.*

Bennis Combustion Ltd.

After all charges, the net profit is £71,416 (*£63,920*). The final dividend is 10% making a total of 15% (*12½%*).

Bullers Ltd.

For the year ended 31 July last, the net profit is £62,005 compared with £89,101 a year ago. The final dividend of 10% again makes a total of 15%.

General Electric Co., Ltd.

The uninterrupted progress of the company since the war was continued with increases both in production and sales during the year ended 31 Mar. last, Sir Harry Railing, the chairman, stated at the meeting last Thursday. Sales increased both for capital and consumer goods.

This was made possible mainly, because since the end of the war they had reinvested savings and modernised and extended manufacturing facilities in both fields, perhaps with greater emphasis on capital goods. Since 1947 £14 millions have been spent on plant and buildings alone. In the consumer goods market, which suffered a sharp decrease both at home and abroad in the previous year, the general improvement expected at home on account of the lifting of the ban on promotional activities for domestic appliances had been realised. Abroad as well, sales of consumer articles increased. The total orders received during the year were less than in the previous twelve months, mainly in connection with capital goods, but this had enabled the company to offer competitive deliveries in most goods. In the home market, a continuation in the volume of orders for capital and consumer goods was expected, with the B.E.A.'s plant extensions now being about 2,000 MW per year, the N.C.B. continuing to mechanise the mines, and the Transport Commission having given indication of going ahead with railway electrification. In the export market, they had to meet the competition of countries whose industries bore a lower rate of taxation and whose labour rates were much below ours—in Germany for instance, in the engineering industry by some 25%. In addition to stressing the need for restraint in wage claims, and for a further reduction in taxation (58% of the company's profit was absorbed by tax), Sir Harry said prices could not be kept at a proper level without sufficient home demand, while prices at home could only remain at the present level if the volume of export business did not decline. The U.S.A. possessed an inland market for manufactured goods six times greater than our own, and a much smaller percentage of exported manufacture. The U.K. economy was therefore much more affected by variations in export.

Mexican Light and Power Co.

The Electricity and Gas Tariff Commission has approved a rate increase averaging approximately 21%, it is announced. In addition the government has granted the company certain tax advantages in order to avoid a higher increase in rates at this time. Reporting this, Mr W. H. Draper, chairman of the company, says this action should substantially improve the company's earning status, but will not compensate the company for the additional heavy expenses of the past few months. Net profit for the quarter ended 30 June last amounted to $257,305.

Permali Ltd.

It is the intention of the directors to offer to members a further 500,000 shares for subscription in the very near future. In the meantime, an extraordinary meeting is being held on 4 Oct. to increase the authorised capital to £350,000 in Ordinary Shares. This is to permit the issue of shares to the vendors of Horden-Richmond Ltd., which is being acquired by Permali Ltd., as we have noted. It is now stated that the consideration to be paid for their acquisition of this issued capital is £100,000 in cash and 750,000 shares of 2s. each.

Roan Antelope Copper Mines Ltd.

Arrangements have now been announced for the financing of the proposed new electrolytic refinery at Ndola, Northern Rhodesia. Of the £3 millions which it is estimated would be required, two-thirds are to be provided by Roan Antelope and the other third by British Insulated Callender's Cables Ltd. It is stated that the money will be available as and when required by the subscription at par of Ordinary shares in Ndola Copper Refineries Ltd., the capital of which will accordingly be increased to £3 millions from the present nominal sum of £100. The decision of Roan Antelope Copper Mines to erect a refinery with an initial capacity of between 55,000 and 60,000 tons of electrolytic copper p.a., was announced last March. Originally it was suggested that the Roan Co. would take up the Ordinary Capital and the remainder would be in the form of loan capital to be offered to outside parties.

Scottish Cables (South Africa) Ltd.

Trading profit for the twelve months ended 30 June last is £203,271 (*£373,562*). The dividend is again 12½%.

Sturtevant Engineering Co.

It is proposed to double the authorised capital to £1,000,000 and to make a free issue of new shares on a one-for-one basis from general reserve. Consent of the C.I.C. has been obtained.

Dividends Declared

Aberdare Cables (*Holdings*). Interim of 7½% (*5%*).

Drayton Regulator Co. (*Holdings*). Interim of 10% (*same*).

Hoffmann Manufacturing Co. Interim of 5% tax free (*same*).

Sturtevant Engineering Co. Interim of 5½% tax free (*same*).

Superheater Co. Interim of 10% (*same*) on enlarged capital.

John Thompson. Interim of 10% (*same*) but on increased capital.

Watford Electric and Manufacturing Co. Interim of 5% (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

2 Oct.—Lanark C.C. Electrical work in proposed rural police station and house, Auchinloch, by Lenzie. Apply to W. R. Watt, County Architect, 34 Albert St, Motherwell, by above date.

2 Oct.—Newburn-on-Tyne U.D.C. Installation in 11 bungalows at Newburn and 32 houses on West Denton estate. J. A. Weatherley is Council Surveyor.

4 Oct.—Ely R.D.C. Wiring and provision of electrical equipment in existing council houses at Pymore (14), Redmere (8), and Black Horse Drove (10). Documents from W. Clifford Jones, engineer and surveyor, Rural Council Offices, 11 Lynn Rd, Ely, Cambs, by above date.

4 Oct.—Morecambe and Heysham T.C. Electrical installation in total of 64 houses and 36 flats in Branksome Drive, and in four shops and eight flats in Trumacar Lane. Borough Surveyor. Deposit £1.

5 Oct.—Liverpool T.C. Electrical installation at Wellesbourne Rd County Primary School. City engineer and surveyor, Municipal Buildings, Liverpool 2.

6 Oct.—Tyne Improvement Commission. Three shallow pit-type non-reversing electric wagon shunting capstans with pedal operated switches. J. K. McKendrick, secretary, Bewick St, Newcastle-upon-Tyne 1.

6 Oct.—Wembley T.C. Dismantling of gas street lamps and erection of 471 45 W or 60 W sodium vapour discharge lamps for conversion scheme.—See 23 Sept. issue.

7 Oct.—Eire. Electric lighting installation at Killybegs Boatyard, E. MacKenna, 67 Lower Mount St, Dublin

8 Oct.—West Sussex C.C. Installation of new passenger lift in existing staircase well at Budgenor Lodge, Midhurst. Apply to county architect, County Hall, Chichester, by above date.

9 Oct.—Caerphilly U.D.C. Rewiring of Council Offices, Mountain Road. Details from Engineer and Surveyor, Council Offices, Caerphilly. Deposit £1. 1s.

11 Oct.—Ellesmere U.D.C. Provision and erection of 19 sodium discharge lamps on the Chester-Birkenhead Rd at Childer Thornton. Engineer and surveyor, Queen St, Ellesmere Port. Deposit £2. 2s.

11 Oct.—Esher U.D.C. Installation in Council Offices (main block).—See Sept. 23 issue.

11 Oct.—Kingston-upon-Hull T.C. Electric light and power installation in 72 six-storey flats, Porter St. City Treasurer, Guildhall, Hull. Deposit £1. 1s.

11 Oct.—Kirkcaldy. Electrical work in proposed new C. of S. church at Templehall, Kirkcaldy.—See Sept. 23 issue.

11 Oct.—Lurgan (N.I.) T.C. Lighting and power installation at Castor's Bay waterworks.—See 9 Sept. issue.

11 Oct.—Mirfield U.D.C. Three electrically-driven pumps at Shepley Bridge Sewage Pumping Station. Engineer and surveyor, Council Offices, Mirfield. Deposit £3. 3s.

11 Oct.—Orpington U.D.C. Supply and installation of group "A" fluorescent lighting at High St. Engineer and surveyor, 46 Barkhart Rd, Orpington. Deposit £2.

12 Oct.—Grantham T.C. 668 concrete columns and wall brackets with lanterns and control gear.—Advertised in 16 Sept. issue.

12 Oct.—Wellington (Salop) U.D.C. Supply, erection of 31 class A 140 W sodium lighting units with concrete columns.—See 23 Sept. issue.

13 Oct.—Belfast T.C. Renewal of electrical installation in Albertbridge Fire Station, Albertbridge Rd. Particulars from Fire Brigade Headquarters, Chichester St, Belfast. Deposit £2. 2s.

14 Oct.—Grimsby T.C. Installation in new police H.Q.—See 9 Sept. issue.

15 Oct.—Sheffield T.C. Electrical installations in 120 dwellings (10 blocks of maisonnettes) at buildings scheme 4a Greenhill-Bradway estate. Apply to J. L. Womersley, city architect, city architect's department, Town Hall, Sheffield, by first post 1 Oct. Deposit £2.

18 Oct.—Dublin Board of Assistance. Removal of existing electrical installation at the Male Infirmary, St. Kevin's Institution, and the provision of a complete installation, including: lighting, cooking, sterilising, nurse's call, fire alarm, radio and lift installations. Specifications from N. Mathews, consulting engineer, 42 Fitzwilliam Place, Dublin. Deposit £10.

18 Oct.—Northern Ireland Housing Trust. Electrical installations in 255 houses at Rathcoole No. 5a, Whitehouse, Belfast. Specification, etc., from offices of the Trust, 12 Hope St, Belfast. Deposit 10s.

18 Oct.—N. Ireland Housing Trust. Electrical installation in 61 dwellings at Donaghmore Rd, Dungannon. Particulars from the Trust, at 12 Hope St, Belfast. Deposit 10s.

20 Oct.—Newcastle-on-Tyne T.C. Installation in 68 flats and maisonnettes on Elswick St site.—See 23 Sept. issue.

25 Oct.—Hindley U.D.C. Supply and installation of approximately 146, 140 W sodium lanterns, lamps and control gear, together with the supply and erection of 44 concrete columns, the supply and erection of 102 steel brackets to existing poles, plus all wiring and auxiliary gear on 3·37 miles of class A road. Engineer and Surveyor, Town Hall, Hindley. Deposit £2. 2s.

26 Oct.—Southgate T.C. Contract A: supply of lanterns and control gear for 139 140 W sodium vapour discharge lamps; contract B: supply and erection of 138 concrete lamp standards and fixing 139 lanterns, control gear, wiring, etc. Borough Engineer and Surveyor, Town Hall, Palmers Green, N.13.—Advertised in this issue.

27 Oct.—Manchester T.C. Electrical installation at Wythenshawe West Secondary Technical School. City architect, Town Hall, Manchester. Deposit £1. 1s. Advertised this issue.

29 Oct.—Donegal C.C. Electrical installation in new district hospital, Carndonagh, Co. Donegal. J. C. Costello, consulting engineer, 21 Leeson Park, Dublin. Deposit £10. 10s.

29 Oct.—Kirkcaldy T.C. Electrical work in 150 traditional brick houses at Bogie Mains No. 1 and 2 sites. J. Gentles and Son, quantity surveyors, Osborne Hse, Kirkcaldy.

29 Oct.—Oswaldwistle U.D.C. Installation in 32 dwellings on White Ash Estate.—See 16 Sept. issue.

No date stated.—Barrhead T.C. Electrical work in erection of two- and three-storey flats and flatlet blocks, comprising 22 houses at Graham St. Apply to William Baillie and Son, architects, 4 West Regent St, Glasgow C.2.

Date not stated.—Brandon and Byshottles U.D.C. Supply of electrical goods for 49 houses at Ushaw Moor. F. Hedley, Architect and Surveyor, Council Offices, Langley Moor, Durham.

No date stated.—North Berwick T.C. Electrical installation work in joining of burgh clubhouse and golf pavilion. Apply to A. Robertson, burgh surveyor, 2 Quality St, North Berwick.

No date stated.—Wigtown. Installation in 84 houses at Kirkcowan and Dunragit.—See 9 Sept. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 117 queries answered this week

"Dallan" darkroom pyramid fitting, makers of? T.B.—David Allan (Dallan Products) Ltd., 119 Haggerston Rd, E.2.

Hunter's head lamps using a dry battery, makers of? A.P.C.—Pifco Ltd., 36/37 Upper Thames St, E.C.4.

"Bedalux" cleaners, repairers of? E.M.E.—Thorn Electrical Industries Ltd., 145 Kentish Town Rd, N.W.1.

"Vitopan" pressure cookers, makers of? S.E.B.—Easiwork Ltd., 29 Goodge St, W.1.

500 W wall-mounted reflector fire, makers of? B.W.—The nearest we can find is 600 W bowl fires such as are made by Premier Electric Heaters Ltd., Crown Hse, Aldwych, W.C.2.

Ceiling fan with provision for a lighting fitting beneath the blades, makers of? F.B.C.—Revo Electric Co., Ltd., Tividale, Tipton, Staffs.

"Corona" blankets, makers of? T.E.—Denhams (Nch) Ltd., St. George's Works, All Saints Rd, W.3.

"Tempaflex" heaters, makers of? B.C.—Flexaire Ltd., 108 Victoria St, S.W.1.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

11 Oct.—India. 32,900 a.c. house service meters, 230 V, of 2·5, 5, 10, 20 and 25 A capacity; also 7,691 ditto 400/230 V, for unbalanced loads of 5 up to 200 A; four trivector meters and five kWh meters with M.D. indicators, for Government of Madras Electricity Department. B.o.T. (Ref.: 22907/54).*

12 Oct.—Persia. Four searchlights, 220 V, with 1,000 W lamps, for use in observation towers, for the General Administrations of Customs, Tehran. B.o.T. (Ref.: 22982/54).*

13 Oct.—South Africa (*a*) Ten 3-ph., 750 kVA transformers and seven 300 kVA 1-ph. transformers; (*b*) twenty 3-ph. 750 kVA transformers with on-load tap changing, or twenty 750 kVA transformers with voltage regulating equipment, for City of Cape Town. Copies of details and drawings to be sent to Merz and McLellan, Carliol Hse, Newcastle-upon-Tyne. Tenders to city electrical engineer, Electricity House, Strand St, Cape Town.

15 Oct.—Madras. Insulators: 25,000 11 kV pin K; 5,000 11 kV strain; 4,000 33 kV pin; 500 33 kV strain, 5,000 11 kV post, 2,000 22 kV post; and 1,000 33 kV post type, for Government of Madras Electricity Department, Superintending Engineer, Technical (electrical), 157 Mount Rd, Madras, 2. B.o.T. (Ref.: 229006/54).*

16 Oct.—Uruguay. 3,000 dry rectifiers for Administracion General de Las Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 22536/54).

18 Oct.—India.—Pin insulators, 20,500 for 11 kV and 16,100 for 33 kV; 6,600 11 kV strain insulators and 3,600 33 kV strain sets: for Government of Andhra. Executive Engineer, Electrical and Mechanical Division, 20 Rutland Gate, Nungambakkam, Madras 6. B.o.T. (Ref.: ESB 22491/54).

19 Oct.—Formosa. 27 current balancing auto-transformers, 60 cycles, 600 V, 50 VA; 6 potential transformers, 11 kV, 11 kV/110 V, 350 VA; and 6 current transformers indoor dry type, 15 kV, 1,500/5 A, 135 VA, for Taiwan Power Co., 39 East Huo-ping Rd, Taipei. Also 2 sets of 20 element group fault indicator, switchboard type; 6 directional over current relays, 3 voltage relays, 115 V, plunger type, and 2 sets of load interrupter switches, 69 kV, 600 A. B.o.T. (Ref.: 22547 and 22546).

20 Oct.—India. 17,500 6·6 kV pin insulators with "I" pins, ditto with "J" pins, and 5,500 6·6 kV shackle insulators, for Government of Andhra. Electricity Dept., 20 Rutland Gate, Nungambakkam, Madras 6. B.o.T. (Ref.: ESB 22492/54).

20 Oct.—Southern Rhodesia. Lightning arresters for 11 kV system, alternatively distribution arresters of the arc discharge type or of the valve type, for operation at 5,000 ft altitude 30° C., for Electricity Commission, Salisbury. B.o.T. (Ref.: 22968/54).*

21 Oct.—Uruguay. For public lighting: 500 enamelled iron mounts, reflectors, and 2,850 round opal glass globes. B.o.T. (Ref.: ESB 22147/54).

25 Oct.—Australia. Four 132 kV busbar protection relays equipments for Tallawarra power station; three 132 kV and two 33 kV ditto for Springhill substation, and similar equipment for Lake Macquarie power station and six substations, for the Electricity Commission of New South Wales. Details available from office of Agent General for N.S.W., 56 Strand, London, W.C.2.

26 Oct.—Pakistan. Two 5,000 kVA transformers, for Director-General of Supply and Development, Frere Rd, Karachi. B.o.T. (Ref.: 22982/54).*

29 Oct.—India. Five diesel driven 325 kVA alternator set, 440 V, 3-p.h.; 4-wire 50 cycles, with control gear; one 325 kVA diesel generating set, 440-400/254-231 V.; twelve transformer control cubicles, two l.t. feeder control cubicles, and one station auxiliaries control cubicle. Director General, India Store Dept., 32/44 Edgware Rd, W.2. Sh. 15s.

4 Nov.—New Zealand. 3,000 bundles of cadmium copper No. 2 tapes, to B.S. 178; 11 tons of copper wire binding, 60 lb per mile; 200 tons of cadmium copper wire to B.S. 175, 70 lb per mile, and 50 tons ditto, 40 lb per mile, for Post and Telegraph Dept., Windsor Building, 49 Willis St, Wellington, C.I. B.o.T. (Ref.: 22527/54).

24 Nov.—Australia. Design, manufacture and erection of No. 1 pipeline and associated structures, Kiewa, for State Electricity Commission of Victoria. Particulars from office of Agent General for Victoria, Melbourne Place, Strand, London, W.C.2.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 21 September

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	273	+17½	233¾
„ (3 months)	254½	+10	222½
LEAD, refined pig, min. 99·97% purity (cash)	103¾	+2¾	93¾
„ (3 months)	100¼	+1¼	89⅛
TIN, refined, min. 99·75% purity (settlement)	735	−2½	613¾
„ (3 months)	735	−2	605½
ALUMINIUM, ingots 99-99·5%	150	—	150
ZINC, virgin, min. 98% purity (cash)	81½	+⅜	71⅜
„ (3 months)	81¼	+⅜	68⅜
RUBBER No. 1, RSS. spot (per lb.)	21⅛d.	+⅛d.	18⅛d.
„ c.i.f. basis, ports. Nov. (per lb.)	20⅛d.	+⅛d.	18⅛d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52½	—	50½
Mild Steel Tape (0·014 in.)	40½	—	40

Contracts Placed

Air Ministry. Three year contract for fluorescent fittings for all home and overseas R.A.F. stations, including dimmer operated control tower lighting equipment, Thorn Electrical Industries Ltd.

Battersea B.C. Installations in 192 flats in Anerley St scheme, Alpha Manufacturing and Electrical Co., Ltd., £11,504.

Bournemouth T.C. Supply and erection of 45 sodium vapour street lighting units in class A, General Electric Co., Ltd., £2,200.

Burnley T.C. Electrical work in 92 houses on Far Brunshaw estate, Williams Bros. Ltd., £2,222.

Darlington T.C. Installation at Firth Moor primary school, William Sykes and Son, £1,260.

Falmouth T.C. Installation in 237 houses, G. R. Ennor, £2,090.

Norwich T.C. Provision of street lighting on first stage of Heartease estate, Erecon Ltd., £2,370.

Ramsgate T.C. Fluorescent lighting in Royal Parade and Paragon, and Madeira Walk, S.E. Electricity Board, £2.259.

Southport T.C. Installation in 54 dwellings on Radnor Drive site, Brooks and Southworth, £1,377.

Wallasey T.C. Installation at Mosslands Drive secondary technical school for boys, Parry's Ltd., £6,543.

Gazette Announcements

COMPANIES ACTS

Astra Supply Co., Ltd., 30a Sandgate High St, Folkestone. Mr J. M. Clarke, senior official receiver and liquidator, of Inveresk Hse, 346 Strand, London, W.C.2, released as from 6 Sept.

Midelect Co., Ltd. Creditors to send particulars to T. W. Pell, C.A., 187 Wollaton St, Nottingham, by 5 Oct.

Northern Rhodesia Power Corpn. Ltd. Meeting of members at 11 Old Jewry, E.C.2, on 2 Nov., at 11 a.m., to receive report of Mr R. V. Pritchard, liquidator, on winding-up.

Domestilux Ltd. Meeting of members at 203 Regent St, W.1, on 22 Oct. at 12 noon to receive report of Mr T. A. Moodie, liquidator, on winding-up.

BANKRUPTCY ACTS

Receiving Order

High Court of Justice. Jager, Alexander, electrical engineer, late of 64 Cholmley Gardens, N.W.6, and 408 Edgware Rd, W.2.

Adjudications

Brentford. Summers, William Edward, mechanical and electrical engineer, "Trelawn," Brox Rd, Ottershaw, Surrey, and of Power Rd, Chiswick.

Release of Trustee

High Court of Justice. Van Den Bosch, Francois Joseph Gerard, lately trading as Vacuum Physical Laboratories, Dunbar Works, Dunbar St, West Norwood S.E.27. Trustee, W. H. D. Campbell, 10-13 Dominion St, E.C.2, released as from 9 June.

York. Vasey, Edwin, electrician, 21 Bridge Rd, Bishopsthorpe. Trustee, Mr W. H. Meredith, 29 East Parade, Leeds. Release date, 15 Sept.

Dividend

Hastings. Thompson, James Henry, and Why, Henry Arthur, lately trading in partnership as Southern Radio TV Electrical Services, at 52 Wellington Mews. First and final dividend of 4½d. in £, payable on 12 Oct., at Official Receiver's office, 8 Old Steine, Brighton.

BUSINESS PROSPECTS

Home

Airdrie T.C. Dean of Guild Court approved plans for 198 houses on Burnfoot and Craigneuk sites.

Barnet (Herts). T.C. To apply for consent to borrow £2,260 for rewiring 87 houses.

Bath T.C. Plans approved for 450 dwellings at Tiverton and Whiteway sites.

Birmingham T.C. Erection of 119 dwellings on Bath Rd Redevelopment Area. City Architect, Civic Centre.

Blackpool T.C. Erection of self-service store with 4 maisonnettes above on Mereside estate. Borough Surveyor, P.O. Box 17, Municipal Bldgs.

Brampton. Plans approved for a light engineering works for Gulstad Mfg. Co., Ltd., Tweed Mill.

Bristol. Louis Eroi, 27 Knightrider St, E.C.4, is architect for proposed £170,000 offices at Wine St.

Carlisle T.C. Erection of school at Harraby. City Surveyor, 18 Fisher St.

Cockermouth (Cumb) R.D.C. Plans approved for 68 houses at Broughton Moor.

Chester-le-Street. J. G. Cowe and Sons, Central Chambers are architects for factory additions for D. and M. Cash Ltd.

Crewe T.C. Layout of Marshfield Bank estate approved. It comprises 318 houses and 80 flats.

Crosby T.C. Erection of 128 houses and 12 flats on Thornton estate. Borough Engineer and Surveyor, Town Hall, Waterloo, Liverpool.

Cumberland. Two additions, of 42.000 and 17,000 sq ft, to be made to Whitehaven factory of Marchon Products Ltd. Architects are R. Ward and Partners, 33 St George's Drive, London, S.W.1.

Darlington T.C. Erection of Arth Pease County primary school. Borough Architect, Central Bldgs.

Denbighshire. Final instalment of Wrexham modern school has been included in next year's building programme. Estimated cost, £47,250.

Dumbarton. Dean of Guild Court has approved plans for shops at Castlehill housing scheme for the Dumbarton Equitable Co-operative Society Ltd, 306 Dumbarton Rd, Old Kilpatrick.

Dunfermline. Erection of 52 houses at Aberdour Rd, Scottish Special Housing Association, Ltd., 15/21 Palmerston Place, Edinburgh.

Gateshead. R. W. Gregory and Partners, Pilgrim Hse, Newcastle, are electrical consultants for proposed 14,000 sq ft factory additions for Perga Cartons Ltd.

Guisborough. J. H. Napper, Eldon Place, Newcastle-on-Tyne is architect for new school.

Heywood B.C. Erection of 32 houses on Hardfield site. Borough Engineer and Surveyor, Municipal Bldgs.

Holt (Norfolk). G. T. Redgment, 76 Prince of Wales Rd, Norwich, recommended for approval as consulting engineer for reorganisation of electrical services at Kelling Sanatorium.

Leven (Fife) T.C. Erection of 218 houses at Durie Broom, scheme approved.

Liverpool. Willink and Dod, Cunard Bldg, are architects for factory extensions in Duke St for J. Langdon and Sons, Ltd.

Llanelly R.D.C. Erection of 60 houses on Capel No. 2 site. Council Architect, 4 Queen Victoria Rd.

Longbenton. F. Boreham, Son and Wallace, Victoria Hse, Southampton Row, W.C.1, are architects for first part of factory for Thos Headley and Sons Ltd, City Rd, Newcastle-on-Tyne.

Loughborough (Leics.) T.C. Erection of 24 houses at Ashby Rd site. W. Granger, Borough Surveyor, Southfields.

Lowestoft C.C. To apply for sanction to borrow £78,450 to build first part of college of further education.

Lowestoft (Suffolk) T.C. Erection of 52 houses at Kirkley Gdns, and Whitton estate and 35 at Beeches estate, tenders recommended to be invited.

Markinch. J. Haig and Co. Ltd, to erect £115,000 block of offices.

Middlesbrough T.C. Erection of 103 houses at Pallister Park. Borough Engineer.

Newcastle-on-Tyne T.C. Tenders invited for erection of new premises for City Lighting Dept. at Grays Brick Field. City Architect, 18 Cloth Market. Also erection of 62 houses and old people's dwellings at Kenton Nth Estate.

Newcastle-on-Tyne. Work expected to begin shortly on rebuilding Appollo cinema in Shields Rd, Byker. Architects are Stienlet and Son, 4 Queens Sq.

Newport, (Mon.) T.C. M. E. approved 1955/6 school building programme, Duffryn Secondary school, £88,700, Ringland primary £88,088.

Norfolk. Erection of first section of King's Lynn Technical College. F. Lincoln, County Education Offices, Stracey Rd, Norwich.

Northampton. Regional Hospital Board is to build new nursing wing at St. Christopher's Home, Abingdon, at cost of £20,000.

North Riding. Clevely and Bass, 47 Gordon Sq, London, W.C.1, are Quantity Surveyors for proposed Thirsk Grammar and Modern School.

South Shields T.C. Erection of 134 houses at Whiteleas estate. Borough Engineer, Town Hall.

Stratford-on-Avon T.C. Recommended to approve plans for 22 detached and 34 pairs of houses at Birmingham Rd for H. Dare and Son, Ltd, 962 Alum Rock Rd, Birmingham 8.

Sunderland. S. W. Milburn and Partners, 9 Esplanade, are architects for factory on 13 acre site for Edison Swan Electric Co., Ltd.

Taunton R.D.C. To erect 55 houses in 1955.

Tiverton. Erection approved of a secondary modern school (£132,300) and school extensions (£25,000) for 1955/56 for County Education Committee.

Uttoxeter (Staffs) R.D.C. Layout plans approved for further 52 houses at Cope's Park Farm estate.

Walsingham R.D.C. To erect 50 houses at Waterfield site, Holt Rd.

Overseas

Colombia. Riccardia and Cia, S.A., Avenida Jimenez, 9-43 Bogsta, wish to represent on a commission basis U.K. manufacturers of various electrical equipment, including hydro-electric generating plant.

U.S.A. The Abbott Instrument and Engineering Co., 7579 Melrose Ave, Los Angeles, California, wish to act as manufacturers' agents on a commission basis of U.K. makers of optical and measuring instruments.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Refrigeration Exchange Ltd. Healey Croft, East Ardsley, nr. Wakefield. Suppliers of domestic, industrial and other refrigerators and cold storage apparatus, etc. Nom. cap.: £1,000. Dirs.: A. J. R. Hooper, H. Gillings and Edith Gillings.

Willsbridge Industries Ltd. 114 Bath Rd, Willsbridge, nr. Bristol. Mechanical, aeronautic, electronic and general engineers, etc. Nom. cap.: £7,000. Dirs.: N. B. Jones and Mrs M. S. Jones.

P.P. Engineering Co., Ltd. Electrical, wireless, mechanical, heating, motor and general engineers, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: P. J. Saunders and Elsie Archer, 5 Queen Anne St, W.

Powaid Ltd., Estate House, Hadleigh, Essex. Manufacturers, assemblers and sellers of hearing aids for the deaf, and in connection therewith to acquire and use the registered trade mark "Powaid," and also electrical goods, boxes, cartons, etc. Nom. cap.: £100. Dirs.: R. J. Coleman and R. H. Pettitt.

W. Wilkinson and Co. (Halifax) Ltd., Excelsior Works, Bedford St North, Halifax. Electrical engineers, electrical installation contractors, etc. Nom. cap.: £2,000. Dirs.: J. Mitchell and J. H. Thorp.

Worsley Mesnes (Holdings) Ltd. To acquire and hold shares, stocks, debentures, etc. Power is taken to carry on business of manufacturers of and dealers in machinery, plant, engines, machine parts and accessories, tools and appliances of all kinds; engineers, etc. Nom. cap: £100. Dirs.: to be appointed by subs. Subs.: D. J. G. Carr and A. R. Normand, 11, Waterloo Place, S.W.1.

Carlton Electrical Co., Ltd., Sandal, Wakefield, Yorks. Electrical engineers, nuclear fission engineers, etc. Nom. cap.: £5,000. Dirs.: R. Addy and G. L. Simmons.

G. H. Northover Ltd., 28 Watergate St, Chester. To take over business of radio, television, electrical and refrigeration engineers carried on as "G. H. Northover" at Chester, by Geo. H. Northover. Nom. cap.: £3.000. Dirs.: G. H. Northover and J. Benton.

Fenn's (Farnborough) Ltd., 273 Farnborough Rd, Farnborough, Hants. Manufacturers of and dealers in scientific instruments, etc. Nom. cap.: £5,000. Permt. Dirs.: A. E. Fenn and E. E. Fenn.

Telefix Ltd., 76 Shepherd's Bush Rd, W.6. Manufacturers, installers, servicers and suppliers of spare parts for electronic apparatus, etc. Nom. cap.: £1,000. Dirs.: H. Dennie and L. A. Harding.

Gilbert Photo-Electronics Ltd., 332 Upper Richmond Rd, S.W.14. Manufacturers of photo-electric or light responsive cells, electron tubes, etc. Nom. cap.: £2,000. Dirs.: V. H. Gilbert and Mrs D. Gilbert.

Morley and Sons (Electrical) Ltd., 109 Kenton Pk Cresc, Kenton, Harrow. Electrical Engineers, etc. Nom. cap.: £500. Dirs.: J. N. Morley and Mrs J. E. Morley.

MEETINGS TO NOTE

THURSDAY, 30 SEPT.

INCORP. PLANT ENGRS. (Sheffield). Brains Trust: Fuel Conservation. Grand Hotel, 7.30 p.m.

ENGINEERS GUILD. Sixth annual meeting at Caxton Hall, Westminster, 6 p.m.

FRIDAY, 1 OCT.

A.S.E.E. (Liverpool). "Off Peak Space Heating." C. J. Wheeler. Liverpool Engrng. Soc., 9 The Temple, 24 Dale St, 7.30 p.m.

A.S.E.E. (N.W. London). "Modern Electric Repair Shop Practice." E. H. Hymas. Century Hotel, Forty Ave, Wembley Park, 8.15 p.m.

ELECTRICAL TRADES' COMMERCIAL TRAVELLERS' ASSOC. Annual ball at Park Lane Hotel, Piccadilly, London, 7 p.m.

MANCHESTER ASSOC. OF ENGINEERS. Inaugural address.

INST. OF FUEL (S. Wales). "Preparation of Water for Use in Steam Boilers." W. F. Gerard. S. Wales Inst. of Engrs., Park Place, 6 p.m.

MONDAY, 4 OCT.

I.E.E. (N.E. Radio and Measurements). Chairman's address by D. H. Thomas. King's College, Newcastle, 6.15 p.m.

I.E.E. (S. Midland). Chairman's address by A. R. Blandford, annual meeting and conversazione. James Watt Memorial Inst., Great Charles St, Birmingham, 6 p.m.

I.E.E. (N. Staffs). Chairman's address by J. M. Ferguson. Tech. College, Stafford, 7 p.m.

I.E.E. (Western). Chairman's address by A. N. Irens. Elect. Offices, Colston Ave, Bristol, 6 p.m.

I.E.E. (Maidstone). "Fuel Supplies of the Future." D. Hicks. Wig and Gown Hotel, 7.30 p.m.

N.E. ELECTRICAL CLUB. Annual meeting and presidential address. Liberal Club, 98 Pilgrim St, Newcastle, 6 p.m.

E.P.E.A. (London Local Group). "Modern Generating Plant Problems." C. C. Hitchen and G. M. S. Sichel. Caxton Hall, S.W.1, 7 p.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Kingsway. 721,468. Class 11. Electric ceiling fans. General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Stroller. 731,742. Class 9. Radio receivers. E. K. Cole Ltd., Ekco Works, Priory Cres, Southend-on-Sea.

Bentric. 730,806. Class 11. Electric lighting installation and fittings. Benjamin Electric Ltd., Brantwood Works, Tottenham, N.17.

Thorn Electrical Industries Ltd., in design. B644,049. Irons and starting and current controlling devices for discharge lighting. Thorn Electrical Industries Ltd., 105/109, Judd St, W.C.1.

Polycone. 730,684. Class 9. Flexibles, insulated wire and cables. Concordia Electric Wire and Cable Co., Ltd., Trent Mills, Derwent St, Long Eaton, nr Nottingham.

Panachord 730,916 and **Panatrope** 730,917. Class 9. Gramophones, etc. Decca Record Co., Ltd., 1/3 Brixton Rd, S.W.9.

Vacrelay. 732,212. Class 9. Relays. R. G. Dixon (Worthing) Ltd., 25 Wordsworth Rd, Worthing, Sussex.

Euk. 731,003. Class 11. All goods. Euk Catering Machinery Ltd., Wellington Works, Wellington St, Oldham.

Flexicraft. 732,034. Class 11. Lampshades. C. E. Campeanu, 95 Cromer St, W.C.1.

A.S.E.E. (Bolton Branch). "Switchgear, Protection and Capacity." Mr Tyrrell. Balmoral Hotel, Bradshawgate, 7.30 p.m.

A.S.E.E. (Leeds Branch). "Electronics in Industry." A. Williams. Gt, Northern Hotel, 7.30 p.m.

A.S.E.E. (N.E. London). Film Show. Angel Hotel, Ilford, 8 p.m.

I.E.S. (Leeds). Modelling with Light and Colour: J. W. Howell, Y.E.B., Ferensway, Hull, 7.30 p.m.

TUESDAY, 5 OCT.

I.E.E. (N. Midland). Chairman's address by W. A. Crocker. Elect. Offices, 1 Whitehall Rd, Leeds, 6.30 p.m.

I.E.E. (N. Western). Chairman's address by Prof E. Bradshaw. Engrs. Club, Albert Sq, Manchester, 6.30 p.m.

I.E.E. (S.E. Scotland). Chairman's address by E. O. Taylor. Carlton Hotel, North Bridge, Edinburgh, 7 p.m.

I.E.E. (Rugby). Chairman's address: "Changing Outlook in Electrical Measurement." D. Edmundson. College of Technology and Arts, 6.30 p.m.

INCORP. PLANT ENGRS. (Edinburgh). "Trends in Industrial Instrumentation. A. B. Dryburgh, 25 Charlotte Sq, 7 p.m.

INCORP. PLANT ENGRS. (London). "Controlled Air Conditions in Factories." D. J. Hyam. Royal Soc. of Arts, W.C.2, 7 p.m.

A.S.E.E. (S. London Branch). "Atomic Research." The Hall, Congregational Church, Court Road, Eltham, 8 p.m.

A.S.E.E. (Portsmouth Branch). Lecture at B.E.A. Conference Rooms, High St, Old Portsmouth, 7.30 p.m.

A.S.E.E. (W. London Branch). "The General Principle of H.V. and L.V. Networks that supply the West End of London." F. B. Evitt. Windsor Castle Hotel, 134 King St, Hammersmith, 7.30 p.m.

WEDNESDAY, 6 OCT.

I.E.E. (Tees-side). Chairman's address by E. J. Grubb. Cleveland Scientific and Tech. Inst., Middlesbrough, 6.30 p.m.

I.E.E. (S.W. Scotland). Chairman's address by R. J. Rennie, 39 Elmbank Cres, Glasgow, 7 p.m.

I.E.E. (Southern). Chairman's address by E. A. Logan. College of Technology, Portsmouth, 6.30 p.m.

BRITISH INSTN. OF RADIO ENGRS. (S. Wales). "Design of Switching Circuits." Prof Emrys Williams. Annual Meeting. Cardiff College of Technology, Cathays Park, 6.30 p.m.

INCORP. PLANT ENGRS. (Southampton). "Control of Maximum Demand and Power Factor." A. W. Ingram, Polygon Hotel, 7.30 p.m.

A.S.E.E. (N. London Branch). "The Association." E. A. Bromfield. Queens Head, 677 Green Lanes, Harringay, N.4, 7.45 p.m.

A.S.E.E. (Preston Branch). "The Development of Alloys for Electric Heating Elements." H. Hodges, Chamber of Commerce, 49a Fishergate, 7.30 p.m.

NORTH WESTERN FUEL LUNCHEON CLUB. "King Cotton and King Coal." W. T. Winterbottom. Engineers' Club, Albert Sq, Manchester, 12.45 p.m.

I.E.S. (Edinburgh). "Home Lighting," A. H. Young and C. J. Misselbrook. 12 Rothesay Place, 7 p.m.

THURSDAY, 7 OCT.

I.E.E. (London). Inaugural address of president, J. Eccles. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Bristol Students). Chairman's address: "Electricity in Modern Aircraft," by E. T. Barry. Elect. Showrooms, Bath, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (Merseyside). "Liverpool University Cyclotron." M. J. Moore. Liverpool University, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (Scottish). Annual meeting (6.30 p.m.) and debate (7 p.m.) on "Does Industry want Electronics?" 39 Elmbank Cres, Glasgow.

INCORP. PLANT ENGRS. (Peterborough). "Plant Maintenance and Productivity." R. A. Rogers. Dujon Cafe, Market Place, 7.30 p.m.

A.S.E.E. (S. London Branch). "Electrical Hazards and Electrical Safety." Col. S. J. Emerson. Cafe Royal, North End, Croydon, 8 p.m.

INCORP. SALES MANAGERS' ASSOCIATION. Annual dinner, Claridge's Hotel.

I.E.S. (Glasgow) "Home Lighting," A. H. Young and C. J. Misselbrook. 39 Elmbank Cres, 7.30 p.m.

I.E.S. (Nottingham). "The Lighting Engineer Gets Down to Earth," A. Roberts. Nott. and Dist. Tech. Coll., 6 p.m.

FRIDAY, 8 OCT.

E.I.B.A. (Birmingham). Annual carnival dance at G.E.C. Magnet Club, Witton, 8 p.m.

E.I.B.A. (Essex). First Ball at Shire Hall, Chelmsford.

WOMEN'S ENGINEERING SOC. Annual conference opens in Birmingham.

INCORP. SALES MANAGERS' ASSOCIATION. Annual Conference. Victoria Halls, Bloomsbury Sq, W.C.1.

I.E.E. (N. Eastern Students). "Inventions and their influence on industrial organisation and management." W. G. Bryce. Grey Hall, King's College, Newcastle-upon-Tyne, 6.30 p.m.

MONDAY, 11 OCT.

I.E.E. (London Students). Chairman's address: "History of the Institution." M. C. Cubitt. Savoy Place, W.C.2, 6.30 p.m.

I.E.E. (Mersey and N. Wales). Chairman's address: "Cables—Some Post-War Trends." P. R. Dunn. Royal Instn., Colquitt St, Liverpool, 6.30 p.m.

I.E.E. (N. Eastern). Chairman's address by G. W. B. Mitchell. Neville Hall, Westgate Rd, Newcastle, 6.30 p.m.

I.E.E. (S. Midland Supply and Utilisation). "Design Features of Semi-Outdoor Power Station at Ince." F. H. S. Brown. Imperial Hotel, Birmingham, 6 p.m.

I.E.E. (Western Supply). Chairman's address by E. Hywel Jones. S. Wales Inst. of Engrs., Park Place, Cardiff, 6 p.m.

I.E.E. (Norwich). "Possibilities of Cross-Channel Power Link between British and French Supply Systems." D. P. Sayers, M. E. Laborde and F. J. Lane. Assembly Hse, 7.30 p.m.

LEICESTER ELECTRICAL SOC. "Electrical Equipment in a Modern Airliner," by official of British European Airways. Elect. Offices, Charles St, 7 p.m.

TRADE NOTES

Pakistan Duty on Engines. The Pakistan Government has decided to grant protection to the diesel engine industry for 3 years ending 30 June, 1957. The existing duty of 5% has been raised to 35% on engines up to 50 h.p., but will not apply to diesel engines coupled to electric generators.

New Phone No. As from 1 Oct., the telephone number of the head office of Berry Wiggins and Co., Ltd., at Field House, Breams Buildings, E.C.4, is being changed to Chancery 4499.

New Branch. Progress Cables and Accessories Co., Ltd., have opened a branch at 12, St. George's Sq, Huddersfield. Telephone No.: Huddersfield 6469.

Change of Address. As from Tuesday, 5 Oct., new premises will be occupied by the London office and Export Division of Dorman and Smith Ltd. and associate companies, D. S. Plugs Ltd. and British Klockner Switchgear Ltd. The new offices are situated at 125, High Holborn, W.C.1. Telephone Nos. CHAncery 6431-2-3. New stock and storerooms, too, will open at 21 Little Russell St, W.C.1.

Typical Hewittic rectifier for mass charging of batteries

Hewittic Rectifiers

REGD. TRADE MARK

for battery charging

Hewittic wall-mounting vehicle battery charger for charging a **30***-cell lead acid battery at* **30** *amps. maximum*

A Hewittic vehicle battery charger providing a maximum charging rate of **30** *amps. for* **80***-cell lead acid batteries, as used for* **2½** *ton electric vehicles*

MAINTAINED EFFICIENCY

The maintained efficiency of the Hewittic mercury arc glass bulb Battery Charging rectifier ensures that the correct charging rate to the battery will always be given irrespective of the number of years that the charger has been in service. (Hewittic chargers supplied 10 or 20 years ago are still working without loss of efficiency).

FULLY AUTOMATIC

Hewittic chargers can be designed to provide either a natural current taper or an automatic two rate charge depending upon the charging time available. They cut out automatically when the battery is fully charged, and can be set to give a slow equalising charge.

MAXIMUM BATTERY LIFE

Maximum life from the battery is ensured by the fact that Hewittic chargers are designed in accordance with the technical recommendations of battery makers many of which use Hewittic rectifiers in the formation of battery plates.

The high degree of electrical robustness of Hewittic chargers enables them to withstand reasonable sustained overloads, and their rectifying properties are unaffected by adverse atmospheric conditions. They are made in types and capacities for multiple or individual charging of all types of batteries. For small charging capacities Hewittic SenTerCel selenium rectifier equipments can be supplied.

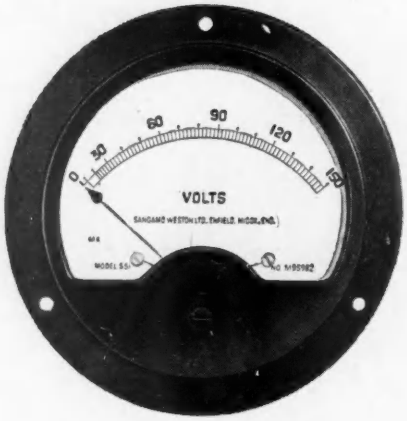
Ask for Publications R228 and R235

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone : Walton-on-Thames 760 (8 lines) *Telegrams : "Electric, Walton-on-Thames"*

WESTON panel instruments

Both round and rectangular models of moving iron, moving coil, A.C. rectifier and H.F. thermocouple types are offered. In the range of rectangular instruments, which have been introduced to give the advantage of long, easily-read scales and to harmonize with rectangular panels, certain models are available with illuminated dials. Full particulars of types and ranges available are to be found in leaflets List Nos. W.1 and W.2, copies of which are available on request.

Rectangular panel instruments are available with scale lengths of 2·5", 3·2", and 4·2". These offer the advantage of an increase in scale length of approximately 50% over their equivalent round models, for which they can be used as direct replacements using the same panel fixing holes.



Round models are housed in cases of 2", 2½" and 3½" diameter and have scale lengths of 1·7", 2·1" and 2·8" respectively.

Larger instruments, both round and rectangular and for switchboard or panel mounting, are also available. These have scale lengths of 6" and 6¼" respectively.

SANGAMO WESTON LIMITED

Enfield, Middlesex · Tel: ENField 3434 (6 lines) & 1242 (6 lines) Grams: Sanwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151
Branches: London, CHAncery 4971 · Glasgow, Central 6208 · Manchester, Central 7904 · Newcastle-on-Tyne, Newcastle 26867
Leeds, Leeds 30867 · Liverpool, Central 0230 · Wolverhampton, Wolverhampton 21912 · Nottingham, Nottingham 42403
Bristol, Bristol 21781 · Southampton, Soton 23328 · Brighton, Brighton 28477

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

BOROUGH OF GRANTHAM

ELECTRIC STREET LIGHTING

TENDERS are invited for the supply and erection of 668 concrete lighting columns and wall brackets together with lanterns and control gear.

Specification and bills of quantities may be obtained from the Borough Engineer and Surveyor, Guildhall, Grantham, on payment of a deposit of £2. 2s., which will be returned on receipt of a bona fide tender.

Tenders, in plain sealed envelopes endorsed "Tender for Street Lighting," should reach the undersigned not later than 10 a.m. on Tuesday, 12 Oct., 1954.

JOHN F. GUILE,
Town Clerk.

Guildhall,
Grantham. (N 129)

CITY OF MANCHESTER

THE Education Committee invite tenders for Electrical Installation required at Wythenshawe West Secondary Technical School: specification and tender form may be obtained from the City Architect, Town Hall. Deposit £1. 1s. (returnable). Tenders sealed in endorsed envelopes, must be delivered before 10 a.m. on 27 Oct., 1954.

PHILIP B. DINGLE,
Town Clerk.

23 Sept., 1954. (N 253)

BOROUGH OF SOUTHGATE

IMPROVEMENT OF STREET LIGHTING ON MAIN ROADS

TENDERS are invited for the following contracts in connection with the improvement of street lighting to Group A standard on certain main roads within the Borough:

Contract A

Supply only of lanterns and control gear for:

139 No. 140 W Sodium Vapour Discharge Lamps.

Contract B

Supply and erection of 138 No. Concrete Lamp Standards and fixing 139 No. Lanterns, control gear, wiring, etc.

Separate contract documents will be issued, and contractors may tender for one or both contracts.

Contractors wishing to tender should apply to the Borough Engineer and Surveyor for a copy of the relevant documents.

Sealed Tenders, in the envelope provided, must be received by the undersigned not later than 9 a.m. on Tuesday, 26 Oct., 1954.

The Council do not bind themselves to accept the lowest or any Tender.

GORDON H. TAYLOR,
Town Clerk.

Town Hall,
Palmers Green, London, N.13.
Sept. 1954. (N 285)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

HER MAJESTY'S COLONIAL SERVICE

ELECTRICAL ENGINEER (SPECIAL TEMPORARY STAFF) P.W.D. UGANDA

DUTIES will include, under supervision, the preparation of an electrical installation scheme including drawings, schedules, specifications and quantities for Lighting in Hospitals, Schools, Streets and Industrial premises: Power in workshops pumping stations, etc., and overhead distribution. The Officer will be trained to undertake accident investigations and factory investigations in connection with electricity supply and installations.

Appointment is on contract for 30-36 months in the first instance in the salary range £884/£1,670 per annum gross, inclusive of temporary cost of living allowance of 35% of basic salary subject to a maximum of £350 per annum. An outfit allowance of £30 is payable on salaries up to £1,134. Free first class sea passages are provided for the officer, his wife and dependent children up to cost of 3 adult fares. Partly furnished Government quarters are provided if available at a rental of 10% salary. Leave is granted at the rate of 5 days per month of resident service.

Candidates between 24 and 30 years of age must be Graduate Members of the Institution of Electrical Engineers and have specialised in Electrical installations.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith St, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number BCD 112/9/06/D10. (N 284)

LEEDS COLLEGE OF TECHNOLOGY

Principal—C. Chew, M.SC.TECH., F.R.I.C.

DEPARTMENT OF ELECTRICAL ENGINEERING AND PHYSICS

APPLICATIONS are invited for the post of ASSISTANT LECTURER in Electrical Engineering subjects, duties to commence as soon as possible.

Applicants should possess recognised technical qualifications in Installation technology with practical experience in electrical installation or maintenance work. Teaching experience would be an added recommendation.

Salary will be in accordance with the Burnham (Technical) Scale, Grade "A," i.e. £450 x £18 to £725 per annum, with full allowances for training, industrial and teaching experience.

Further particulars and form of application to be returned by 15 Oct., 1954, may be obtained by sending a stamped addressed envelope to the Chief Education Officer, Education Offices, Leeds, 1. (N 272)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following positions:

SENIOR ENGINEERING DRAUGHTSMAN (MECHANICAL)
Construction Department
S/13.568

Applicants should have had experience of work concerning turbines and auxiliaries, boilers and auxiliaries, coal and ash handling plant and pipework.

SENIOR ENGINEERING DRAUGHTSMAN (ELECTRICAL)
Construction Department
S/13.569

Applicants should have had experience of the layout of switchgear cables and lighting in connection with power station construction. Experience in schematic diagrams an advantage.

SENIOR ENGINEERING DRAUGHTSMAN (CIVIL AND BUILDING)
Construction Department
S/13.570

Applicants should have had experience of design and detailing of either industrial buildings, or structural steelwork, or reinforced concrete structures and piled and slab foundations for heavy plant, or drainage and sanitation schemes.

Candidates should have a good technical education in either mechanical or electrical engineering or in architecture and building construction.

Salary N.J.B. Grade D.5, £567/£671.

GENERAL ASSISTANT ENGINEER (BUILDINGS)
Construction Department
S/13.571

Applicants should possess an Intermediate R.I.C.S. (Quantities Sub-Division) or H.N.C. (Buildings). Experience in the preparation of bills of quantities and specifications is necessary, and candidates should be able to supervise the measurement of building and civil engineering works.

Salary N.J.B. AX/CX 8, £501/£675.

GENERAL ASSISTANT ENGINEERS
Transmission Sections
S/13.572

Applicants should have had experience in the operation and maintenance of a high voltage system and preferably should have received a works training on high voltage switchgear and transformers. Candidates should possess a Higher National Certificate, or its equivalent, and possession of qualifications leading to corporate membership of an appropriate professional institution will be an advantage.

Salary N.J.B. AX/CX 8. £501/£675.

Special application forms for each of the above positions, obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 13 Oct. (N 271)

MIDLANDS ELECTRICITY BOARD

Birmingham and District Sub-Area

APPOINTMENT OF DISTRICT MANAGER

APPLICATIONS are invited for the position of District Manager in the South East District of the Birmingham and District Sub-Area.

Applicants should have had a wide experience in managerial, engineering, and commercial activities of the Electrical Supply Industry, and preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary in accordance with the N.J.M. Agreement, Scale 4, £1,600/£1,750 per annum, superannuable.

Applications stating age, qualifications, experience, present position and salary, endorsed "District Manager," should be forwarded to: Emil Braathen, Manager, Birmingham and District Sub-Area, Midlands Electricity Board, 14 Dale End, Birmingham 4, not later than 23 Oct., 1954.

A. STEPHENS,
Secretary.
(N 270)

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

SENIOR ASSISTANT COMMERCIAL ENGINEER

APPLICANTS must have had wide and responsible commercial experience in the development of electricity supplies for all purposes and in negotiations with large industrial consumers.

The successful applicant will be responsible to the Sub-Area Commercial Officer for the industrial, street lighting and general consumer development aspects of the Sub-Area organisation.

Preference will be given to those who are Corporate Members of the Institution of Electrical Engineers.

Salary—N.J.B. Class K, Grade 4, £1,093/£1,141 per annum.

Wakefield District

GENERAL ASSISTANT DISTRICT ENGINEER

Applicants must have had a sound practical training with experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants must hold a current driving licence, be prepared to reside in the district and undertake standby duties.

Applicants must hold at least a Higher National Certificate in Electrical Engineering.

Salary—N.J.B. Class F, Grade 11, £548/£565 per annum.

Applications, giving full details of age, qualifications and experience together with the names of two referees should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 14 Oct., 1954.

No. 3 (Sheffield) Sub-Area

ENGINEERING DRAUGHTSMAN

Applicants should be first class draughtsmen, preferably with experience on mains recording with a Public Utility Authority, capable of compiling accurate and permanent records from particulars obtained on site, and carrying out survey work for the revision of ordnance maps and plans.

Salary—N.J.B. Schedule D, Grade 6, £433/£567 per annum.

Sheffield North and South Districts

ASSISTANT INSTALLATION ENGINEER

Applicants should possess a sound technical training and preferably be graduate members of the Institution of Electrical Engineers or possess similar qualifications.

The duties of the post include negotiations with consumers for new and additional supplies of electricity, advice on tariffs and utilisation including Power Factor correction, specifications, estimates and tenders for all classes of installation work, supervision of installations on site and control of staff and workpeople.

Salary—N.J.B. Class L, Grade 12, £667/£692 per annum.

Applications, giving full details of age, qualifications and experience together with the names of two referees should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield, not later than 14 Oct., 1954. (N 248)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

THIRD ASSISTANT ENGINEER (Electrical) is required in the Generation (Construction) Department at Wolverhampton. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 5, commencing in range £649/£790 and ultimately rising to £858 per annum.

Applicants should have had a recognised training in electrical engineering, and should hold a Higher National Certificate. Experience in the design and installation of electrical equipment for power stations or similar industrial work is necessary.

Apply, quoting Vacancy No. 772MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 16 Oct., 1954. (N 266)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF (a) PRINCIPAL ASSISTANT, ORGANISATION, SALARIES AND SUPERANNUATION SECTION, (b) SENIOR ASSISTANT, REVENUE AND BANKING SECTION, CHIEF ACCOUNTANT'S DEPARTMENT, AREA BOARD HEADQUARTERS, MANCHESTER

APPLICANTS for post (*a*) must have wide experience of Superannuation, Salaries and Wages preferably in the Electricity Supply Industry. Experience on procedure and methods and possession of appropriate professional qualifications would be an advantage.

Applicants for post (*b*) must have had wide experience in Accountancy particularly in the preparation of final accounts. Possession of appropriate professional qualifications would be an advantage.

Salary Scales:

Post (*a*)—£895/£1,000 p.a. Grade 8.
Post (*b*)—£670/£730 p.a. Grade 5.
N.J.C. Conditions.

APPOINTMENT OF GENERAL ASSISTANT ENGINEER (TELE-COMMUNICATIONS), TECHNICAL AND RESEARCH ENGINEER'S SECTION, CHIEF ENGINEER'S DEPARTMENT, AREA BOARD HEADQUARTERS

Duties will include maintenance of V.H.F. Radio equipment throughout the Board's area. Possession of H.N.C. in Electrical Engineering or equivalent qualifications will be an advantage.

Commencing Salary within range £501/£639 p.a. rising to £714 p.a. Schedule "C," Class AX/EX, Grade 8, N.J.B. Conditions.

Applications for the above posts to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 9 Oct., 1954.

APPOINTMENT OF GENERAL ASSISTANT ENGINEER (TESTING ASSISTANT), POLYGON TESTING STATION, ARDWICK, MANCHESTER

Applicants should be experienced in testing meters, instruments (including standardisation), cables, protection equipment and substation plant and should hold H.N.C. in Electrical Engineering or its equivalent. Experience in a manufacturer's works will be an advantage.

Salary Scale: £692/£716 p.a. Grade N.13, N.J.B. Conditions.

APPOINTMENT OF SENIOR COMMERCIAL ASSISTANT, SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, MANCHESTER

Duties involve assisting in the general organisation of Sales activities in the Sub-Area, particularly relating to Domestic and Commercial Consumers.

Applicants should have had a wide experience in the organisation and supervision of service centres; planning sales campaigns, preparation of staff training lectures; interior and window displays and exhibition layouts; preparation and giving of lecture demonstrations to outside organisations, and dealing with all types of correspondence from Domestic and Commercial Consumers. Technical knowledge of appliances and installations will be an advantage.

Salary Scale: £730/£805 p.a. Grade 6, N.J.C. Conditions.

Applications for the above posts to the Sub-Area Secretary, No. 1 Sub-Area. The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, by 9 Oct., 1954.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (SYSTEM PLANNING & DEVELOPMENT), SUB-AREA TECHNICAL ENGINEER'S DEPARTMENT, BOLTON

Applicants must have had a sound training in Electrical Engineering to degree or H.N.C. standard and responsible experience in several of the following branches:

(1) Planning and Construction of 33 kV and lower voltage systems.
(2) Maintenance and operation of 33 kV and lower voltage systems.
(3) Substation design and construction.
(4) Calculation of fault levels, etc.
(5) Estimating and Specification of Distribution Plant.

The successful applicant will be required to work at Westhoughton for a period after appointment but will eventually be located at Bolton.

Salary Scale: £766/£794 p.a. Grade L.10, N.J.B. Conditions.

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APPOINTMENT OF ENGINEERING DRAUGHTSMAN, LEIGH

Applicants must have had a good technical training and drawing office experience and should have had experience in the preparation of drawings for some or all of the following:

Switchgear layout and diagrams.
Substation layout and construction.
Overhead line design.
Preparation of wayleave and other plans.

Preference given to applicants holding the O.N.C. in Electrical Engineering and/or Building.

Salary within range £433/£567 p.a. according to qualifications and experience. Schedule "D," Grade 6, N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester 3, by 9 Oct., 1954.

APPOINTMENT OF ASSISTANT (DOMESTIC AND COMMERCIAL SALES), SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, KENDAL

Applicants should have had experience in exhibition and display organisation and advertising and have a good knowledge of agricultural and horticultural applications of electricity.

Salary Scale: £485/£545 p.a. Grade 2, N.J.C. Conditions.

APPOINTMENT OF GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER, CARLISLE DISTRICT

The successful applicant will be required to assist in the preparation of estimates and in the supervision of Contract work for Commercial, Industrial and Street Lighting schemes. Experience in agricultural applications of electricity would be an advantage. H.N.C. standard of education is desirable.

Salary Scale: £447/£460 p.a. Grade E.13, N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 9 Oct., 1954. (N 251)

GOLD COAST LOCAL CIVIL SERVICE

ELECTRICAL ENGINEER/ASSISTANT ELECTRICAL ENGINEER, GOLD COAST RAILWAY

A VACANCY exists for an Electrical Engineer/Assistant Electrical Engineer, Railway Department of the Gold Coast Local Civil Service. Duties are to assist in the operation of the Electrical Workshop at Location and Takoradi.

Appointment is on contract for 2 tours in the salary range £1,030/£2,020 per annum, point of entry depending on experience, plus a gratuity of £37. 10s. for each completed 3 months' satisfactory service. Free 1st class passages are provided for the officer, his wife and up to 3 children under 13 years of age. Government quarters are provided at a rental of £60/£90 per annum, and leave is granted at the rate of 7 days for each completed month of resident service after a tour of 18-24 months.

Candidates between 23 and 45 years of age must have passed Sections A and B of the examinations for A.M.I.MECH.E. or A.M.I.E.E. or hold an engineering degree or diploma granting exemption from Sections A and B of the Institution's examination and have had 2 years' subsequent practical experience. They should have had experience in Workshop and Machine practice, and a knowledge of Electrical and Mechanical Equipment of all types of cranes. They must have served an apprenticeship or served as a graduate student with a reputable firm combining both Mechanical and Electrical Training. In addition they should have knowledge of low tension cable networks, distribution systems and their maintenance and they must be capable of controlling subordinate staff. Preference given to candidates with service in R.E.M.E., R.E., or R.A.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith St, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number BCD 110/13/07/D10. (N 250)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT BOILER HOUSE SHIFT CHARGE ENGINEER, BARKING "A" AND "B" GENERATING STATION
Vacancy No. 54/820

Experience with modern Boiler House operation including Pulverised Fuel necessary. Salary—Class M, Grade 11=£793. 16s. p.a.

ASSISTANT ENGINEER (INSTRUMENTS) BATTERSEA GENERATING STATION
Vacancy No. 54/821

Applicants must have served a recognised apprenticeship and have experience with the general maintenance and calibration of instruments connected with Power Station operation and efficiency control. Salary—Class M, Grade 14=£655. 4s. p.a.

1ST ASSISTANT STATION CHEMIST—TAYLORS LANE GENERATING STATION
Vacancy No. 54/822

Applicants must have experience in a laboratory of a modern high pressure station and be fully conversant with the testing and analysis of fuels, oils and water. Salary—Class F, Grade 9=£637. 7s. p.a.

STATION SHIFT CONTROL ENGINEER WEST HAM GENERATING STATION
Vacancy No. 54/823

Applicants should have sound technical training and practical experience in the control and operation of steam generating plant and main switchgear in modern generating station. Salary—Class H, Grade 10=£673. 1s. p.a.

Applications, quoting Vacancy No. may be made on the form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box No. 136, Generation House, Great Portland St, W.1, to be received within 14 days of this advertisement. (N 261)

OVERHEAD LINESMAN

required by ZANZIBAR GOVERNMENT for one tour of 2-3 years on contract. Salary scale (including present temporary allowance of £192/£257 a year) £782 rising to £1,097 a year. Commencing salary according to qualifications and experience. Gratuity of 13½% of total basic salary drawn during contract. Outfit allowance up to £60. Free passages. Liberal leave on full salary. Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent with not less than five years' experience of construction and maintenance of L.T. and 11 kV overhead lines and service. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/30667/EE. (N 264)

MANCHESTER CORPORATION TRANSPORT DEPARTMENT

ASSISTANT ELECTRICAL ENGINEER

APPLICATIONS are invited for the position of Assistant Electrical Engineer, at a salary which will be in accordance with Grade A.P.T. Va (£650 rising to £710 per annum) of the national scheme of service conditions.

Forms of application together with full details of the duties attaching to the post can be obtained from the General Manager, Manchester Corporation Transport Department, 55 Piccadilly, Manchester 1, and should be submitted to him together with copies of not more than two recent testimonials not later than 18 Oct., 1954.

Canvassing is prohibited.

A. F. NEAL,
General Manager.

55 Piccadilly,
Manchester 1.
21 Sept., 1954. (N 252)

LONDON ELECTRICITY BOARD

ARCHITECTURAL DRAUGHTSMEN

APPLICATIONS are invited for the above positions in the Architect's Section of the Chief Engineer's Department in Central London.

Applicants should be neat draughtsmen and preferably have had several years' experience in an Architect's office.

The post is graded under Schedule "D" of the National Joint Board agreement as Grade 6—£458/£595. 7s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2. Please enclose addressed envelope and quote ref.: V/1785/T on envelope and all correspondence. (N 249)

BRITISH ELECTRICITY AUTHORITY
North West, Merseyside & N. Wales Division

APPLICATIONS are invited for the appointment of ASSISTANT ENGINEER (OPERATION) at the Percival Lane Power Station, Runcorn, Cheshire. Salary £534/£555 per annum N.J.B. Class G, Grade 12. Superannuable and subject to medical examination.

Applicants should have experience in the control room of a modern power station and possess the Higher National Certificate or equivalent qualifications.

Application Forms from the Divisional Controller, Beaconsfield Rd, Woolton, Liverpool. Closing date: 8 Oct., 1954. (N 230)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (MAINTENANCE AND OPERATION)

STAINES District of No. 1 (Southall) Sub-Area. Salary N.J.B. Class F, Grade 9, Column 1 (£637. 7s. per annum, inclusive of London Allowance). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of Switchgear, Transformers, Cables and Overhead Lines up to and including 11 kV, and the appointment will involve stand-by duties.

Applications on forms obtainable from the Sub-Area Secretary, 2/6 Windmill Lane, Southall, Middlesex, and returned to him in envelopes suitably endorsed, not later than 15 Oct., 1954.

JUNIOR ENGINEERS (2)

(*a*) Newbury Sub-Area and (*b*) Newbury District. The commencing salary will be fixed according to the successful applicants' experience and qualifications in accordance with Class 35 of the N.J.B. Agreement, i.e.

	Class	*Minimum Grade*	*Maximum Grade*
(*a*)	"L"	20 (£404)	16 (£547)
(*b*)	"E"	15 (£390)	14 (£445)

N.J.B. Conditions of Service.

The duties of the posts will be:

(*a*) Principally to undertake the testing of protection relays and H.V. 3-phase metering equipments.

(*b*) To assist with distribution duties including minor construction work and general maintenance.

Applicants should have received Technical training to O.N.C. standard and have experience of similar work.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, and returned to him in envelopes suitably endorsed, not later than 15 Oct., 1954.

JUNIOR ENGINEER

Meter Section of No. 1 (Southall) Sub-Area, Engineering Department, Waterloo Rd, Uxbridge. Salary N.J.B. Class L, Grade 16, Column 3 (£574. 7s. per annum, inclusive of London Allowance). N.J.B. Conditions of Service.

Applicants should have experience in 3-phase Meter Testing, Instrument Transformer Testing, assisting in the standardising of wattmeters, and assisting in the commissioning of special equipment.

Applications on forms obtainable from the Sub-Area Secretary, 2/6 Windmill Lane, Southall, Middlesex, and returned to him in

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envelopes suitably endorsed, not later than 15 Oct., 1954.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

METER REPAIRER (MECHANICIAN) CHARGEHAND

Meter Section of No. 1 (Southall) Sub-Area, Engineering Department, Waterloo Rd, Uxbridge. The rate of pay (4s. 3d. per hour) and conditions of service will be in accordance with the National Joint Industrial Council Agreement for the Electricity Supply Industry.

The duties of the post will be to take charge of small section dealing with repair and calibration of indicating recording instruments, etc., together with the reconditioning of pivots and jewels.

Applications, in writing, stating age, qualifications and experience, to the Sub-Area Secretary, 2/6 Windmill Lane, Southall, Middlesex, not later than 15 Oct., 1954. (N 263)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination:

1. SENIOR ASSISTANT (Domestic Sales Development): in the Commercial Department of No. 1 Sub-Area Headquarters in Liverpool. Salary £730/£805 per annum (N.J.C. Grade 6).

   Candidates should have a good knowledge of Domestic Load Development, especially cooking and water heating. They should also have had experience in the control of Outside Sales Representatives and negotiations with local authorities and builders concerning housing estates.

2. GENERAL ASSISTANT ENGINEER: In the Planning Section of No. 1 Sub-Area Headquarters in Liverpool. Salary £616/£646 per annum (N.J.B. Grade 13, Class L).

   Applicants should be experienced in all the aspects in the distribution of electricity and possess knowledge of the technical and economic principles underlying the design of distribution systems and should preferably have the technical qualifications necessary to enable them to become Chartered Electrical Engineers.

3. ASSISTANT SECTION ENGINEER: in the No. 1 Sub-Area (Southport District). Salary £587/£600 per annum (N.J.B. Grade 9, Class E).

   Applicants must have received a thorough technical training and should have had operational experience of H.V. and L.V. networks including substations, and should preferably have the technical qualifications necessary to enable them to become Chartered Engineers.

   Application Forms for posts 1 to 3 are obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool, 3.

4. INSTALLATION INSPECTION ENGINEER: in No. 2 Sub-Area (Warrington District). Salary £577/£598 per annum (N.J.B. Class F, Grade 10).

   Applicants should possess the qualifications necessary to enable them to become Chartered Electrical Engineers. Previous experience in installation work advantageous.

5. ASSISTANT SECTION ENGINEER: in No. 2 Sub-Area (Warrington District). Salary £607/£629 per annum (N.J.B. Class F, Grade 9).

   Applicants should have experience with H.T. and L.T. overhead and underground distribution work, and preferably have the technical qualifications to enable them to become Chartered Electrical Engineers.

Application Forms for posts 4 and 5 are obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Near Northwich, Cheshire.

Closing Date: 11 Oct., 1954. (N 236)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

SHIFT CHARGE ENGINEER
AVON POWER STATION, WARWICK
Vacancy No. 148/54/ET

Applications are invited from qualified Engineers for the position of Shift Charge Engineer at Warwick Power Station.

Applicants should have had experience in the operation of Steam Turbines and Boiler Plant.

Salary in accordance with Class E, Grade 7 (£649/£681 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 11 Oct., 1954.

ASSISTANT ENGINEER (INSTRUMENTS)
DRAKELOW POWER STATION
Vacancy No. 151/54/ET

Applicants should be experienced on Bailey Automatic Combustion Control and also Kents, Cambridge and Foster Instrumentation of all types. A knowledge of Turbine Supervisory Equipment would also be an advantage.

Salary in accordance with Class J, Grade 10 (£680/£706 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 18 Oct., 1954.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
(N 265)

SURREY COUNTY COUNCIL

APPLICATIONS are invited for the appointment of ASSISTANT ELECTRICAL ENGINEER, Grade VII, Salary £735 by £25 to £810 p.a. plus London Weighting. Applicants should be Corporate Members of I.E.E. and experienced in preparation of schemes, specifications, drawings and estimates for, and supervision of, installations of electrical services in large buildings.

Applications giving full details of present and previous appointments and salary attaching thereto, accompanied by copies of 3 recent testimonials, to the County Architect, County Hall, Kingston-on-Thames, by 9 Oct., 1954. (N 238)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments at the Board's No. 2 Sub-Area Headquarters, Sandiway Hse, Nr. Northwich, Cheshire.

SENIOR ASSISTANT ENGINEER (OPERATION). Salary £1,093/£1,141 per annum (N.J.B. Class K, Grade 4).

THIRD ASSISTANT ENGINEER (PLANNING). Salary £719/£750 per annum (N.J.B. Class K, Grade 10).

THIRD ASSISTANT ENGINEER (CONSTRUCTION). Salary £719/£750 per annum (N.J.B. Class K, Grade 10).

GENERAL ASSISTANT ENGINEER (PLANNING). Salary £583/£605 per annum (N.J.B. Class K, Grade 13).

Applicants should be Chartered Electrical Engineers or possess the technical qualifications to enable them to become Chartered Electrical Engineers and also have had experience in overhead and underground distribution work. The appointments are superannuable and subject to medical examination.

Application forms obtainable from the Manager at the above address. Closing date 11 Oct., 1954. (N 237)

CAMEROONS DEVELOPMENT CORPORATION

require for service in British Cameroons, West Africa, an ELECTRICAL SUPERVISOR. Candidates should have served an indentured apprenticeship in the electrical trade, and have had general electrical experience of installing, operating, and maintaining power plants as well as local distribution street lighting and house wiring. A knowledge of line and radio telephones is desirable. Candidates should also have attained foreman status. Age limits 25-35, although an older man might be considered for the appointment. Commencing salary according to ability and experience in scale £775/£1,175. Tours 18-24 months with generous leave on full pay. Outfit allowance £80. Provident Fund contribution 10% employee, 15% Corporation. First Class passages are provided together with free quarters equipped with heavy furniture.

Applications, in writing, giving full particulars to Rubber and Mining Agencies Limited, 52 Leadenhall St, London, E.C.3. Only applications from candidates selected for further consideration will be acknowledged. This post is exempt from the requirements of the Notification of Vacancies Order, 1952. (N 268)

BRITISH ELECTRICITY AUTHORITY
South Wales Division
Vacancy No. 97/54

APPLICATIONS invited for superannuable N.J.B. Appointments of STATION SHIFT CONTROL ENGINEER at Lydney Power Station. Salary D.10, £531/£547 per annum.

H.N.C. and experience in Power Station Control Room desirable.

Application forms obtainable from Divisional Secretary, British Electricity Authority, South Wales Division, British Electricity House, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 11 Oct., 1954. (N 262)

LONDON ELECTRICITY BOARD
SECRETARY

APPLICATIONS for the position of Secretary to the London Electricity Board are invited.

Candidates should have wide experience of the secretarial and administrative work of public authorities, public utility undertakings or large commercial organisations.

The salary will be within the range of £2,750 to £3,250 per annum, but will be settled according to the age, experience and qualifications of the person appointed.

Applications stating age, qualifications, experience and present position and salary, should be made by 18 Oct., 1954, to the Chairman of the Board at 46 New Broad St, E.C.2. (N 235)

MIDLANDS ELECTRICITY BOARD

THIRD ASSISTANT DISTRICT ENGINEER, required in the Evesham District of the Worcester and District Sub-Area. Duties will be primarily concerned with the installation and maintenance of underground H.V. and L.V. mains and ground mounted substations. Experience in the operation and maintenance of overhead distribution systems is, however, necessary. Technical qualifications desirable. Salary £587/£600 per annum (N.J.B. Class E, Grade 9). Superannuable.

Apply in writing, within 14 days stating age, experience, present salary and position to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

A. STEPHENS,
Secretary.
(N 269)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

BRITISH ELECTRICITY AUTHORITY
South Western Division

BOILER HOUSE SHIFT CHARGE ENGINEER required at Portishead "A" Generating Station.

Superannuation Scheme. Salary, N.J.B. Class "J," Grade 9, £719/£750.

Applicants should have had good technical experience, preferably in a generating station, and also a thorough practical and theoretical training in mechanical engineering.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 16 Oct., 1954. (N 267)

APPLICATIONS are invited from ENGINEERS with experience in the cable industry for vacancies in the sales organisation of a large, old established London cable making company. The duties will involve a large amount of travelling and possibly tours abroad from time to time. Candidates should state their age, details of their education, experience and salary required. All applications will be treated with strict confidence.—Box 3857, Electrical Times. (N 229)

A VACANCY occurs in the Transformer Department for a TECHNICAL CORRESPONDENT and ESTIMATOR. The post is a senior one and applications are invited from men with experience in the preparation of tenders for both the home and export markets for all classes of transformers. Apply giving details of experience and salary required to Employment Manager, Messrs Johnson and Phillips Ltd., Victoria Way, Charlton, London, S.E.7. (N 231)

BRITISH ELECTRICITY AUTHORITY Generation Design Branch, Headquarters, London, invite applications for the following vacancies in the Station Development Sub-Branch:

SENIOR AND SECOND ASSISTANT ENGINEERS: Salary including London Allowance £1,002/£1,378; £840/£1,209 respectively.

Candidates should possess an honours degree or the requisite qualifications for corporate membership of either the I.Mech.E. or the I.E.E. and should have sound experience of power station design and if possible a knowledge of the selection of sites for new power stations. Duties will include the planning of new generating plant capacity throughout the country, the coordination and direction of investigations of sites for new stations and the suitability of existing stations for development, and negotiations for statutory and other consents.

THIRD AND GENERAL ASSISTANT ENGINEERS: Salary including London Allowance, £753/£981; £558/£769 respectively.

Candidates should possess an honours degree or the requisite qualifications for corporate membership of either the I.Mech.E. or the I.E.E. Prospective Third Assistant Engineers should have experience in the Electricity Supply or Plant Manufacturing industries, preferably in the field of power station planning or desi

Forms from D. Moffat, Director of Establishments, Winsley St, London, W.1, to be completed and returned by 18 Oct., 1954 Quote Ref. ET/526. (N 282)

CHARGEHAND required by Telephone Manufacturing Co., Ltd., Martell Rd, West Dulwich, S.E.21, to assist in controlling large Coil Winding Section. Previous experience of coil winding essential. Preference will be given to applicants who have worked in the telephone industry. The position offers scope for advancement to the right type of man. Staff status. Good conditions of service. Pension and Staff Bonus Scheme, after qualifying period. Write, call or telephone Personnel Department, GIPsy Hill 2211. (N 274)

CONTRACTS ENGINEER, Cabling, Jointing and O.H. Line experience. Permanent, Pension Scheme. Cable Jointers Ltd., 49 Avenue Rd, Acton, W.3. (N 240)

CHARGEHAND required for all types of Automatic Arc Welding Machines. Progressive position with large Engineering Works in Midlands, Having excellent social and welfare activities. Write giving full details of qualifications and experience to—Box No. 3869, Electrical Times. (N 246)

DESIGNER of Industrial Lighting Fittings. The Benjamin Electric Ltd., Brantwood Rd, Tottenham, N.17, require first class lighting fittings designer for new development work. Apply to the Chief Technical Engineer, giving full details of age, training, experience, salary, etc. (N 286)

DRAUGHTSMAN, ELECTRICAL, with experience of A.C. and D.C. automatic Motor Control Gear. Altrincham district. State qualifications and salary required.—Box No. 3831, Electrical Times. (N 174)

ELECTRICAL ENGINEER wanted. McLellan and Partners, Consulting Engineers, have a vacancy on planning and supervision of cabling and plant installation in a large works in South Wales. Salary £650/£900, depending on experience. Write to 32 Victoria St, London, S.W.1, giving age, education, qualifications and details of experience. (N 228)

ELECTRICAL ENGINEER. The appointment of an engineer with a degree and excellent practical experience is being considered by a Birmingham metal trades company for its head office. Applicants should give concise details of their careers and mention the salary desired. All replies will be treated as strictly confidential: they should be addressed to the Chief Engineer, James Booth and Co., Ltd., Argyle St, Birmingham 7. (N 259)

ELECTRICAL/ELECTRONIC ENGINEER required to take charge of small laboratory. Applicant must have some years' experience in laboratory of manufacturers or large scale users of any of the following: Cables, Capacitors or insulation materials. Maximum age 35. Address London, E.11. Write fullest particulars.—Box No. 3879, Electrical Times. (N 278)

ELECTRICAL FITTERS are required by the British Electricity Authority at their Nottingham Transmission Section. The nature of the work involved includes the overhaul of 132,000 V Transformers and switchgear at Transforming Stations within the Nottingham Section. Previous experience of H.V. Apparatus would be an advantage. Rate of pay 45d. per hour, 44-hour week. Terms and conditions of service in accordance with N.J.I.C. Agreement. Applications in writing to Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham. Please quote Vacancy No. 153/54/ET. (N 273)

ELECTRONIC ENGINEER for research and development post with well-known Birmingham Company. Applicants should possess University degree and have had experience in pulse techniques and digital computer principles. The appointment offers good prospects and conditions in a substantial organisation. Pension scheme. Apply stating age and qualifications to—Box No. 3861, Electrical Times. (N 242)

ENGINEER OR PHYSICIST required by large Company of world-wide renown in Birmingham. Applicants should be well-qualified academically and have experience in experimental physics or instrumentation. The appointment offers good prospects and conditions in a substantial organisation. Pension scheme. Apply giving details of age and qualifications, to—Box No. 3859, Electrical Times. (N 241)

FOREMAN, with mechanical and Electrical knowledge to take charge of shop engaged in building and maintaining all types of Auto-Arc and Resistance Welding Machines. Apply giving details of experience, training and salary required, to—Box No. 3867, Electrical Times. (N 245)

FOREMAN ARMATURE WINDER required for N.E. Scotland repair shop—Council House available.—Box No. 3875, Electrical Times. (N 260)

ILLUMINATING ENGINEER for preparation of specialised lighting schemes and quotations. Applicants should be conversant with current trends in interior lighting practice. I.E.S. member preferred. Write stating age, experience and present salary, to—Box No. 3873, Electrical Times. (N 257)

JOHNSON AND PHILLIPS LTD. have vacancies for DRAUGHTSMEN in their

(*a*) Junction Box Dept.
(*b*) Contract Dept.

Applicants in the case of (*a*) should have experience in Cable Boxes and Accessories and in regard to (*b*) experience in Overhead Lines, Wood Poles, Steel Towers, etc. Applicants giving particulars of age, experience and salary expected, to Employment Manager, Johnson and Phillips Ltd., Victoria Way, Charlton, S.E.7. (N 232)

JUNIOR ELECTRICAL ENGINEER required for small firm in N.E., at least up to H.N.C. standard, with experience of motor control gear and an understanding of schematic and wiring diagrams. Ability to supervise electrical testing and instrument calibration an advantage. State age and salary required. Reply—Box No. 3863, Electrical Times. (N 243)

JUNIOR DESIGNERS required to deal with small transformers, power, audio, pulse, etc. Specialised training will be given to engineers with suitable basic training and experience. Applications to Technical Director, Gresham Transformers Ltd., Twickenham Rd, Hanworth, Middx. (N 275)

LEADING OIL COMPANY requires one ELECTRICAL ENGINEERING DRAUGHTSMAN for work in the Middle East. Age 25-30 years. Candidate should possess the Ordinary National Certificate in Electrical Engineering or have equivalent qualifications. An engineering apprenticeship is required which includes 3 years' practical experience in the shops followed by 3-5 years in the Drawing Office on electrical installations for Process Plants, Workshops and/or Factories. Attractive salary plus generous allowance in local currency, free passages out and home, free medical attention, kit allowance, good leave arrangements. Pension Scheme. Write, stating age and full details of qualifications, quoting F.500 to Box 1263, c/o 191 Gresham House, E.C.2. (N 289)

LEADING OIL COMPANY require an ELECTRO-MECHANICAL DRAUGHTSMAN for design and detail work on experimental laboratory equipment at their Research Station near London. Applicants under 30 years of age. Must be in possession of Ordinary National Certificate and if possible should have had 2 years' workshop experience. Salary according to age, qualifications and experience. Pension Scheme. Write giving full details and quoting H.3156 to Box 7013, c/o 191 Gresham House, E.C.2. (N 276)

MAINTENANCE ELECTRICIANS required for large Paper Mill. Sound experience of large A.C. and D.C. motors and switchgear essential. Bowater's Thames Paper Mills Limited, Northfleet, Gravesend, Kent. (N 254)

BRITISH TITAN PRODUCTS COMPANY LIMITED

Invites applications for the post of
ELECTRICAL DRAUGHTSMAN
At its Grimsby Factory

Applicants should be experienced in the layout of H.T. and L.T. Electrical Power Distribution Schemes in heavy industry.

Salary dependent on age and qualifications, 5 day week, Staff Bonus and Superannuation Schemes.

Applications to Staff Officer, British Titan Products Company Limited, Kronos House, Coppergate, York. (N 256p)

NETTLE ACCESSORIES LTD., Harper Rd, Wythenshawe, Manchester, require REPRESENTATIVE for London, South of the Thames and London South Eastern Electricity Board area. Car owner preferred but not essential. Considerable scope. Staff Pension Scheme operative. Apply in strict confidence, giving details of experience, salary required, etc., to the Sales Manager. (N 108)

STOREMAN, electrical, for receipts and issues required by electrical wholesalers. Apply, giving details experience, wage required, to E. Dawson (LF) Ltd., 10 Gray's Inn Rd, W.C.1. (N 288)

SENIOR TRANSFORMER DESIGNER required with experience of all types of transformers up to 3,000 kVA. Excellent prospects for an energetic man capable of supervising junior engineers. Excellent working conditions, Pension Scheme, Canteen, etc. West London area. Applications to—Box No. 3877, Electrical Times. (N 277)

SENIOR EXPERIENCED ELECTRICAL ENGINEERS required for employment by large Oil Company operating in Venezuela, South America. Candidates should be between 30 and 40 years of age, possess a University Degree in Electrical Engineering or A.M.I.E.E. and have approximately 10 years' experience in the operation and maintenance of power houses, H.T. transmission and distribution. They should have already occupied a position of senior administrative responsibility. These vacancies offer a permanent career involving overseas tours of 3 years' duration with 3 months' U.K. leave at the end of each tour. Leaves are fully paid with free passages for employee and family, local leave first and second years. Furnished accommodation supplied for single or married men. Contributory pension scheme covers both employee and family, kit allowance paid. U.S. dollar salaries in line with qualifications and experience, details given at interview. Travelling expenses paid for interview in London. Please write in confidence, stating age, qualifications and full details of experience to Box ZB.66, Deacon's Advertising, 36 Leadenhall St, E.C.3. (N 195)

TECHNICAL ASSISTANT (Electrical) required for Central London Office for the design and layout of factory electrification schemes including substations, H.T. Ring Mains, Transformers, M.T. switchboards, cabling distribution boards, motors, starters and lighting. Electrical contracting experience would be an advantage.

Applicants must be between 25 years and 30 years of age and must hold the H.N. Certificate in Elect. Eng. Preference to man holding the Graduate Examination of the I.E.E. Five day week. Superannuation Scheme. Salary according to experience. Successful applicant would have to be passed by the Company's Medical Officer.

All applications will be treated in the strictest confidence and should be addressed to Personnel Division (WAD 68), Unilever Ltd., Blackfriars, London, E.C.4. (N 233)

TECHNICAL SALES CORRESPONDENTS are required by Sangamo Weston Ltd. Applicants should preferably have had previous engineering and commercial experience in connection with electrical measuring instruments, but those similarly employed in some other branch of the light electrical engineering industry will be considered. Age desirably 25/35 years. Applications in writing to The Employment Manager, Gt. Cambridge Rd, Enfield, Middx. (N 255)

TECHNICAL ASSISTANT required for testing H.V. Cables. Ordinary national certificate required. Reply giving full details of experience, age and salary required to The Secretary, W. T. Glover and Co., Ltd., Trafford Park, Manchester, 17. (N 239)

TECHNICAL ASSISTANTS required for investigational work in connection with radio valve manufacture. Applicants should possess at least Higher National Certificate. Five-day week, modern welfare facilities, staff pension scheme. Write, giving full personal details, including age, qualifications and experience.—Box No. 3865, Electrical Times. (N 244)

TECHNICAL SALES ENGINEER, Engineering and estimating for automatic electrical motor control gear manufacturers, Altrincham district. State experience, age, salary.—Box No. 3833, Electrical Times. (N 175)

THE ENGLISH ELECTRIC CO., LTD., Stafford, has interesting vacancies for ENGINEERS to assist in the preparation of comprehensive tenders and contracts for hydro-electric schemes. Applications are invited from those having experience of this type of work and also from young engineering graduates or H.N.C. holders who have a background of practical engineering experience, preferably with a commercial bias. Please apply to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 756C. (N 109)

TRANSFORMER DRAUGHTSMAN for all types up to 500 kVA for rapidly expanding company in Surrey. Situation offers excellent opportunity for advancement. Good commencing salary. House could be arranged. Reply in confidence.—Box No. 3881, Electrical Times. (N 279)

TRANSFORMER DESIGNER required for transformers and chokes up to 25 kVA Good opportunity for right man. Write stating experience and salary required. Pearce Transformer Co., Ltd., New Cross, S.E.14. (N 287)

APPOINTMENTS WANTED

AGENT seeks one or two more lines, especially accessories. Excellent contacts with Wholesalers, Contractors, Electricity Boards in London, Home and Eastern Counties Area.—Box No. 3825, Electrical Times. (N 99)

NAVAL ELECTRICAL OFFICER, 29 years of age, married, and available shortly, seeks progressive position in any part of the world, preferably Far East. Experience of A.C. and D.C. motors and control schemes from F.H.P. to 200 h.p. also propulsion equipment of 6,000 n.h.p. and auxiliaries.—Box No. 3883, Electrical Times. (N 280)

WANTED

WANTED. ROTARY CONVERTERS, any size.—Universal, 221 City Rd, London, E.C.1. (N 11)

WANTED, D.C. and A.C. ball-bearing MOTORS, motor generator sets, dynamos and alternators.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London, N.1. (N 10)

WANTED, for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper Ltd., 176 Brady St, Bethnal Green, E.1. (N 9)

PATENTS

THE Proprietors of British Patent No. 677491 are prepared to sell the patent or to licence British manufacturers to work thereunder. It relates to "Improved process for the electrolysis of solutions of alkali metal chlorides."

Address: Boult, Wade and Tennant, 112 Hatton Garden, London, E.C.1. (N 281)

WORK WANTED

ARMATURE REWINDING service to the trade. Vacuums, Drills, Grinders, Hood Dryers, Dental Motors. Vacuum cleaner and drill armatures replaced from stock 24-hour service. Every job guaranteed. All vacuum cleaner parts, hoses, etc., in stock for any make. Apex washer agitator shafts stocked.—Regam Electric Cleaner Service, 95 Park Lane, Leeds 1. (N 13)

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (N 12)

FISHER FOUNDRIES LTD., Greet, Birmingham 11, for Machine Moulded Precision Castings in gun metal and soft grey iron. Tel.: Victoria 0197. (N 14)

FOR SALE

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi. 5105, 67 Rothschild Rd, W 4. (N 16)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co., Ltd., Honeypot Lane, Stanmore, Middx. Edgware 5566-9. (N 17)

A.C. and D.C. MOTORS, all sizes, large stocks. Fully guaranteed.—Milo Engineering Works Ltd., Milo Rd, East Dulwich, S.E.22 (Forest Hill 2278-9). (N 15)

A HIGH VACUUM IMPREGNATION UNIT or single or batch coil impregnation service to R.I.C. specification 214 or individual requirements.—Blickvac, Hamilton Rd Works, Hamilton Rd, S.E.27. Tel. Gypsy Hill 4394. (N 22)

DON'T forget reconditioned Meters are supplied by The Electric Meter Company, Dept. ET46, Castle Circus House, Torquay. (N 179)

DON'T worry about your electricity bills. Fit 1s. slot electric meters for hotels, bed-sitters, etc. Prices from 50s.—Selectrics, Department E.T., Castle Circus House, Torquay. Tel. 7218. Trade inquiries invited. Trade discount. (N 23)

FULLER 175 H.P. MOTOR for sale. Comprising a Fuller Asea 175 h.p. Commutator Motor, shunt type, with 4 h.p. Barring Motor. 0·1 h.p. Moveable Brush Gear Motor, and 1·4 Motor for Forced Draught for ventilation of same. Offers invited. Birmingham Gazette and Despatch Limited, Corporation St, Birmingham 4. (N 290)

FLAMEPROOF MOTORS, M.G. SETS, D.C. MOTORS, GEARED MOTORS, A.C. MOTORS, TRANSFORMERS, CONTROL GEAR. SPECIALS. FLANGE MOTORS

ELECTROPOWER COMPANY LIMITED

Kingsbury Works, Kingsbury Rd, London, N.W.9
Tel.: COLindale 4621/3
Grams: Lectropowa, Hyde, London (N20p)

ELECTRIC CABLE. Heavy duty industrial TRS PILCSWA/S etc. Send for list of over 50 types at greatly reduced prices to clear warehouse.—Box No. 3801, Electrical Times. (N 26)

FOR SALE. PELAPONE DIESEL GENERATOR develops output of 24 b.h.p., and runs at 1,000 r.p.m. Model D.23 Engine No. 6084, with starter motor coupled to a 12 kW 230/250 V D.C. Compound Generator No. 141674 by E.C.C. 1941 manufacture. Write Box 8906, Frost-Smith Advg., 64 Finsbury Pavement, London, E.C.2. (N 283)

HOUSE SERVICE METERS. The Electric Meter Company, Dept. ET46, Castle Circus House, Torquay. (N 178)

HOUSE-SERVICE METERS, a.c. or d.c., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (N 18)

MERCURY SWITCHES are made by Hall, Drysdale and Co., Ltd., of 58 Commerce Rd, Wood Green, London, N.22. Tel.: BOW. 7221. (N 19)

METERS reconditioned, all types, AC/DC, quarterly credit, single and three-phase 3/4 wire, 2½/100 amp. Prepayment single, dual or triple coin, fixed or variable tariff 2½/50 amp. Delivery ex-stock, guaranteed, free catalogue lists 200 types. Trade Discount 33⅓%. The Electric Meter Company, Dept. ET46, Castle Circus House, Torquay. Telephone 7963. (N 177)

M.V. Type K.O.B. metalclad, single busbar, horizontal draw-out type SWITCHGEAR, 3-phase, 50 cycles. Rated breaking capacity 100 MVA at 6·6 kV. 11 units for disposal in good serviceable condition. For full particulars apply to—Box No. 3855, Electrical Times. (N 225)

PAPER CABLES, most sizes in stock at competitive prices.—E. M. Tatton and Co., Ltd., Kew Bridge, Brentford. (EAL. 3155.) (N 258)

PURLEY CHOKES AND BALLASTS Our 80-W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818-9. (N 21)

TIME SWITCHES for sale. Reconditioned or new. 12 months' guarantee. Immediate delivery. List from: J. W. Hughes, 3 St. Thomas' St, London Bridge, S.E.1. (Tel.: HOP 2759.) (N 24)

TWO AEROFLEX 150 amp air-break 3-phase SWITCHES. Twelve Lucy 300 amp Ironclad Cartridge Fuses.—Box No. 3871, Electrical Times. (N 247)

700 YARDS NEW V.I.R. CABLE 37/·064 single core 660 V.

900 YARDS NEW TELEPHONE CABLE 10 core x ·056.

4,500 YARDS CABLE 7/·064 single core 660 V.

Dover Industries Ltd., Eastern Docks, Dover. (N 234)

HUNDREDS OF MOTORS IN STOCK

1, 2, and 3-ph. and D.C. all sizes Geared Motors, M.G. Sets and special equipment made up. Rewinds and redesigns all sizes, 12 months' guarantee on all supplies and rewinds. Lists sent on request.

EDWARDS, WYATT & COURT LTD.
Grant Street, London, E.13. Grangewood 3697

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In order to enable users to obtain T.I. Aluminium with the absolute minimum of delay, we have made arrangements with the companies mentioned opposite to supply all our products in any reasonable quantities.

Arlington Tractors & Accessories Ltd.,
HIGH ROAD, PONDERS END, ENFIELD
Telephone: Howard 1266.

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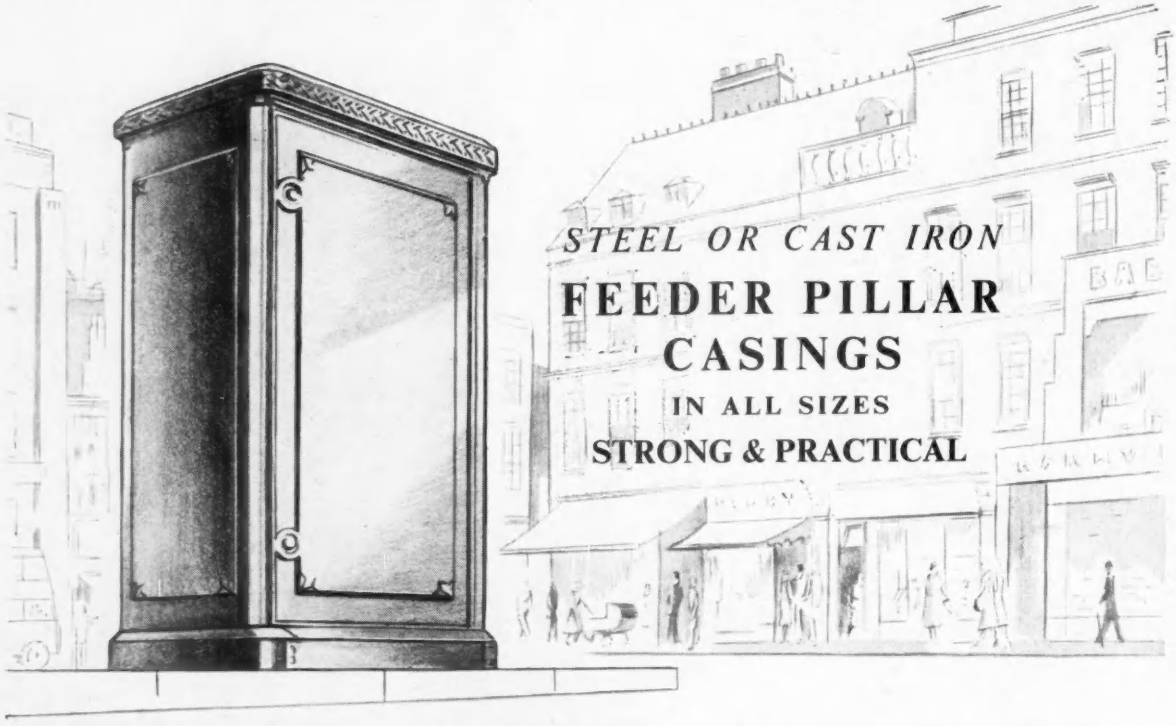

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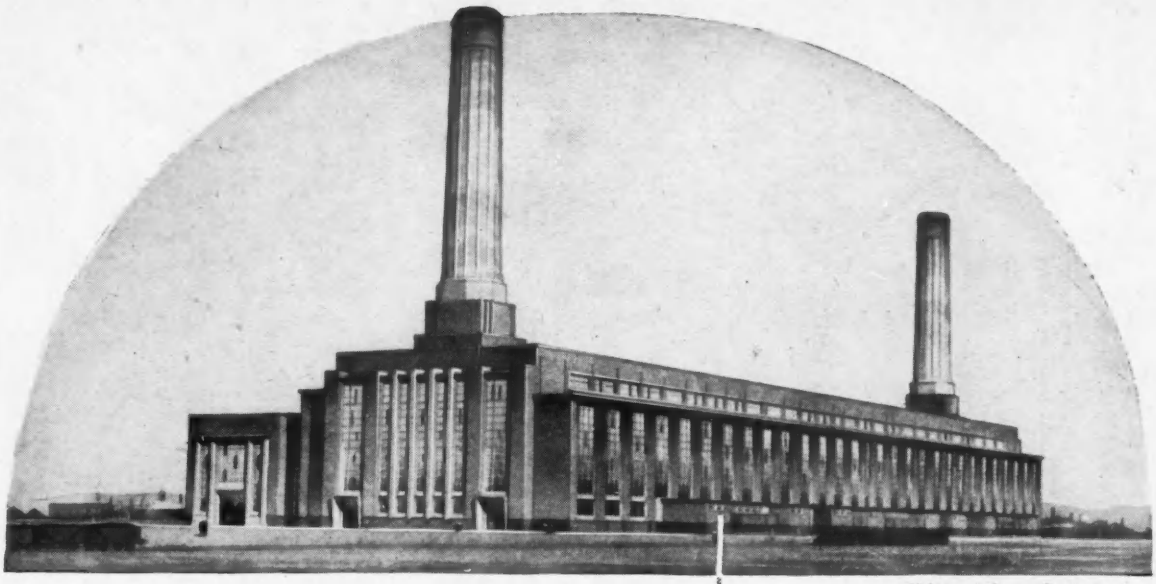

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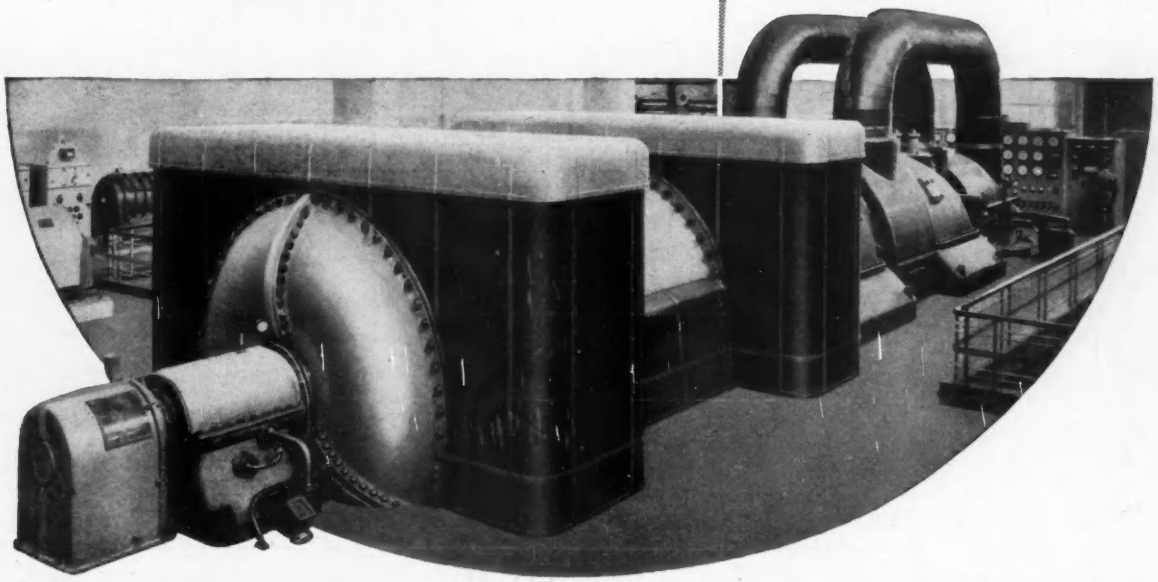

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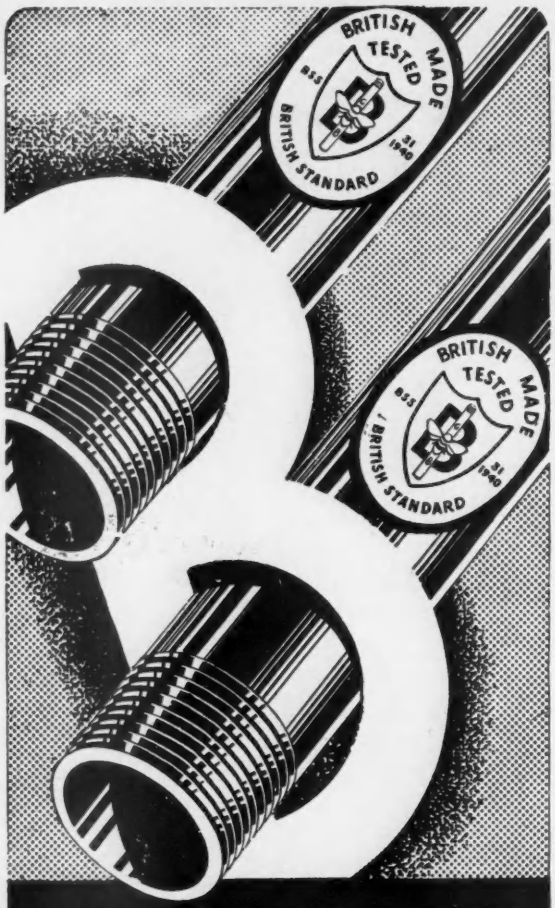

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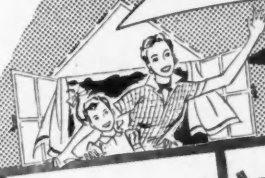

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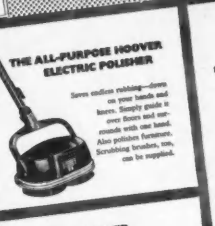

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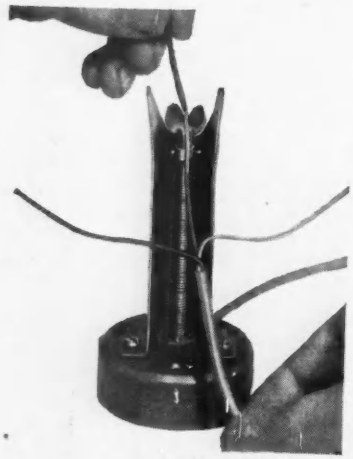

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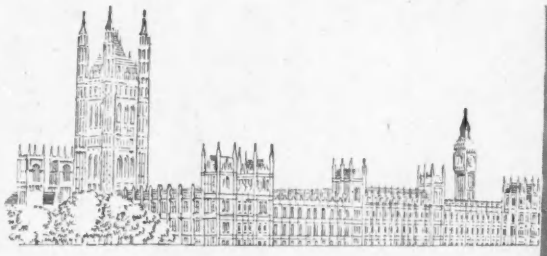

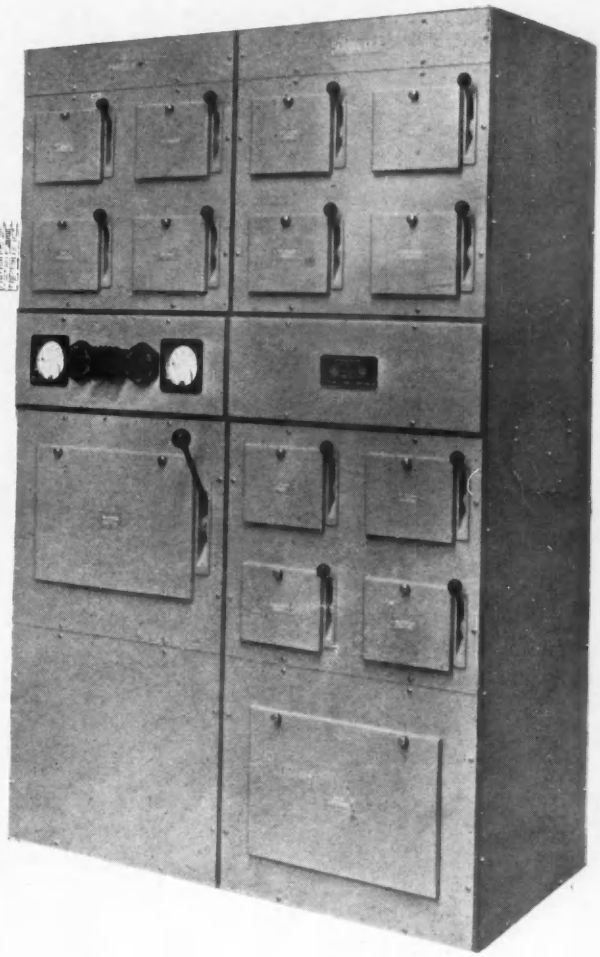

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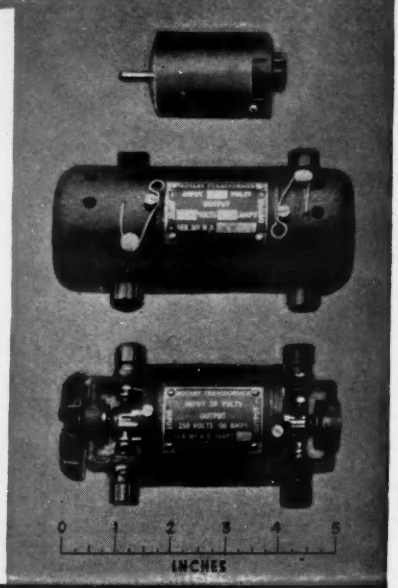

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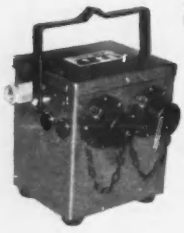

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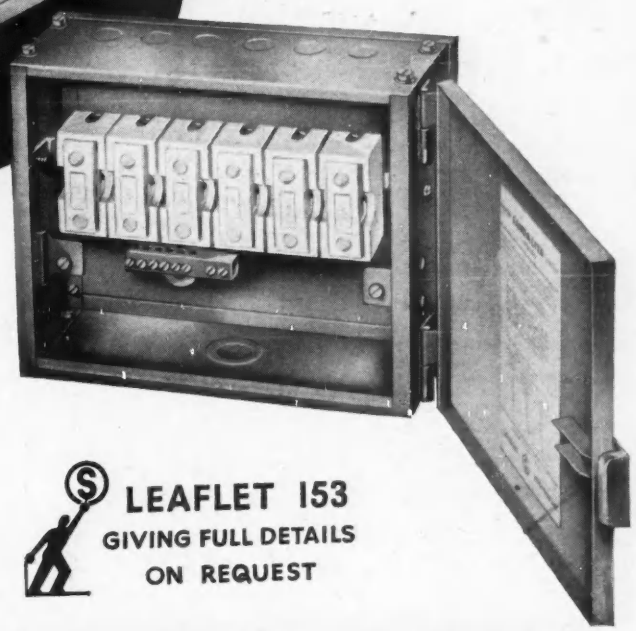

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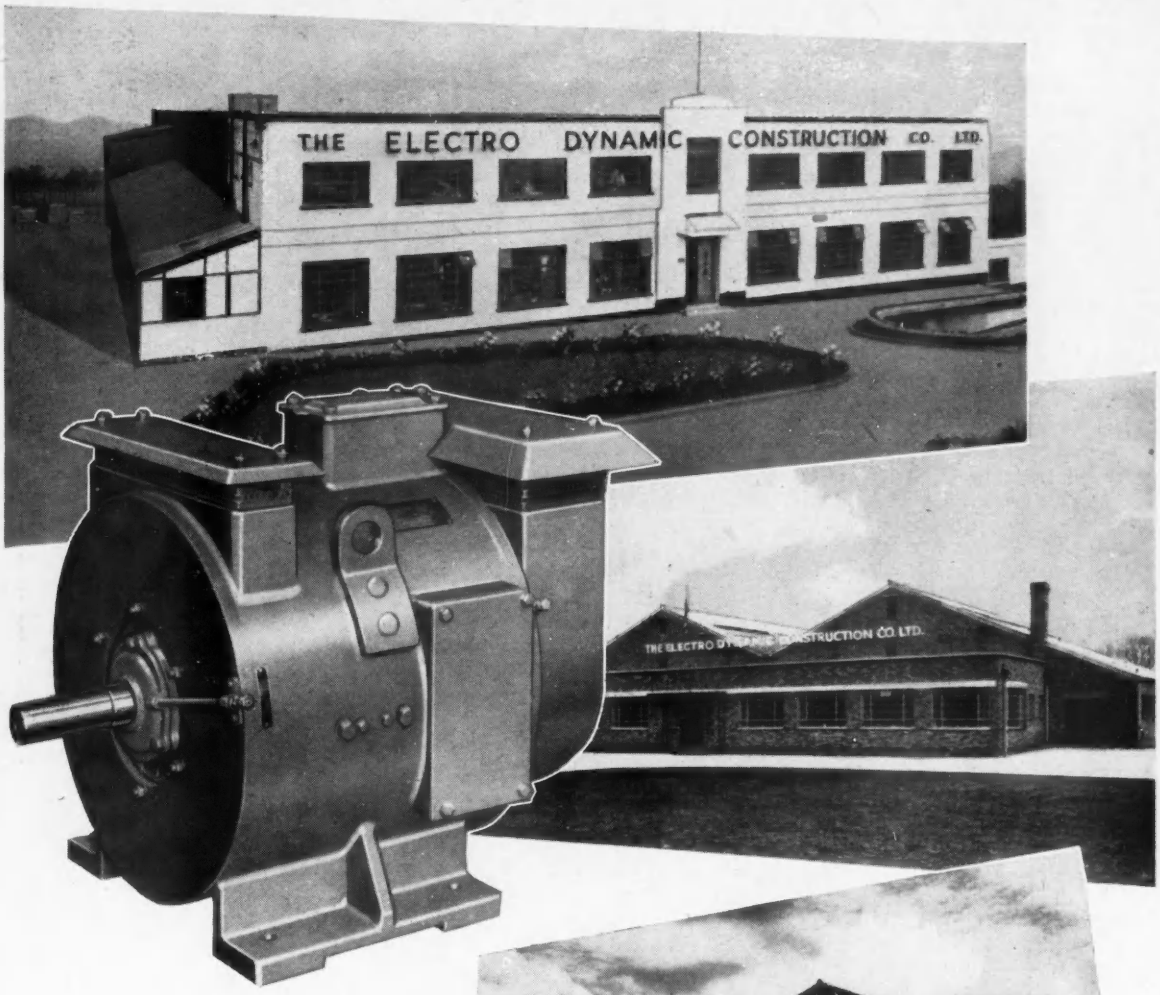

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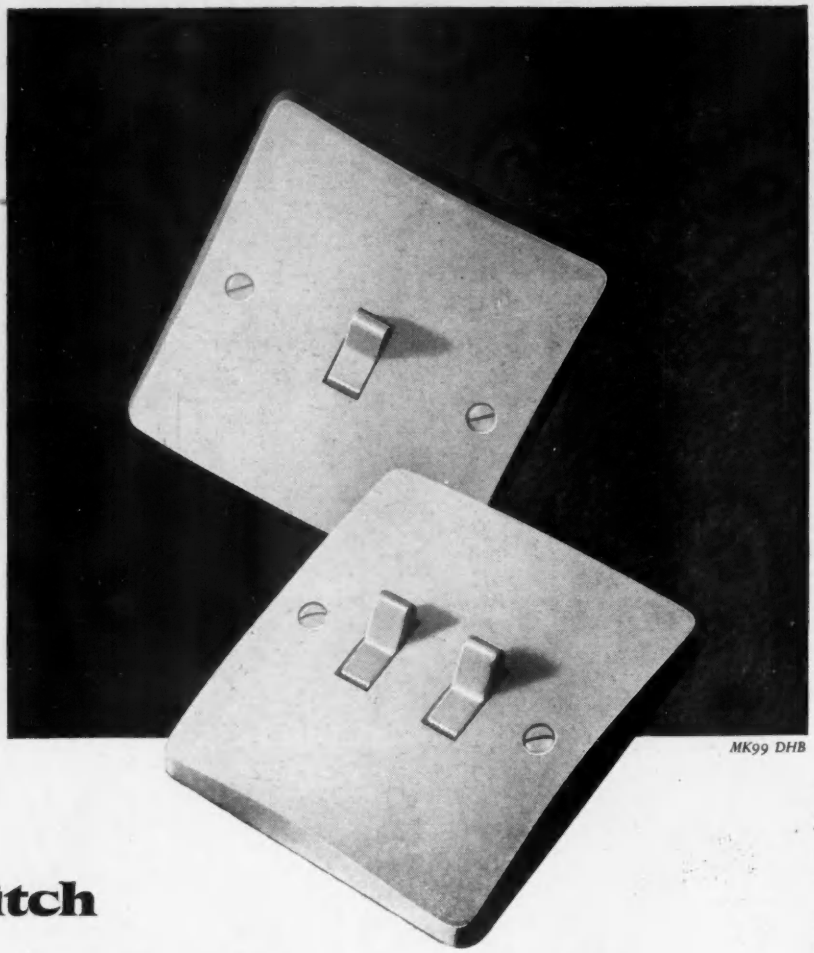

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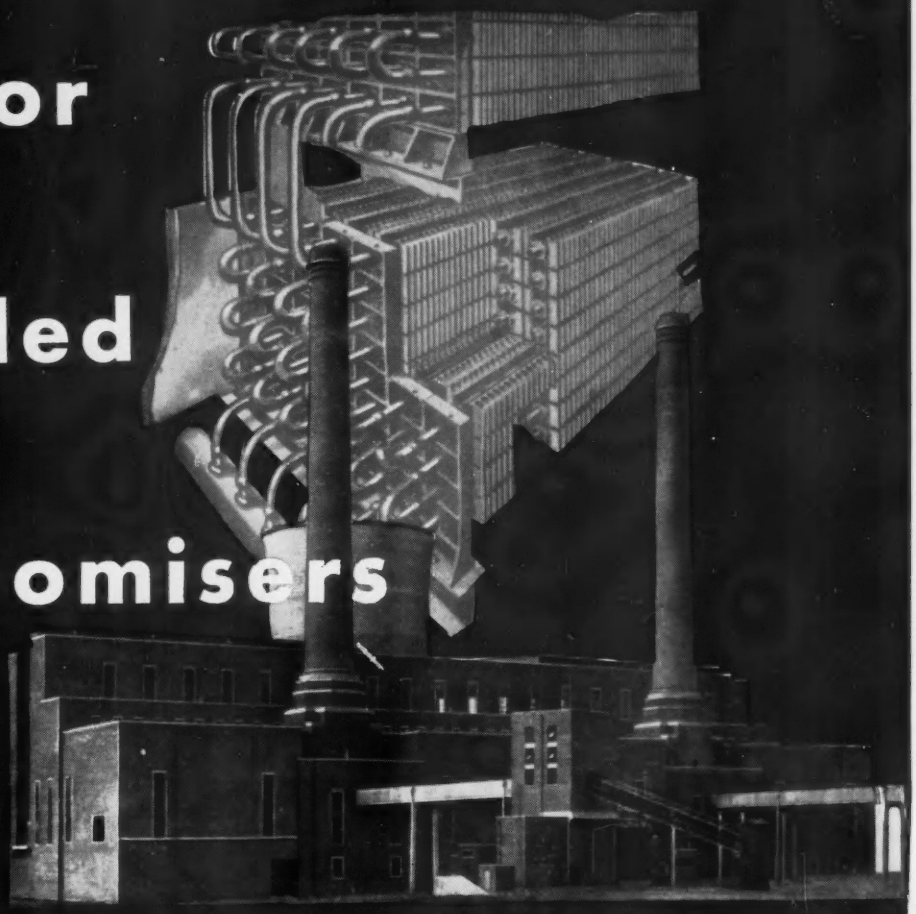

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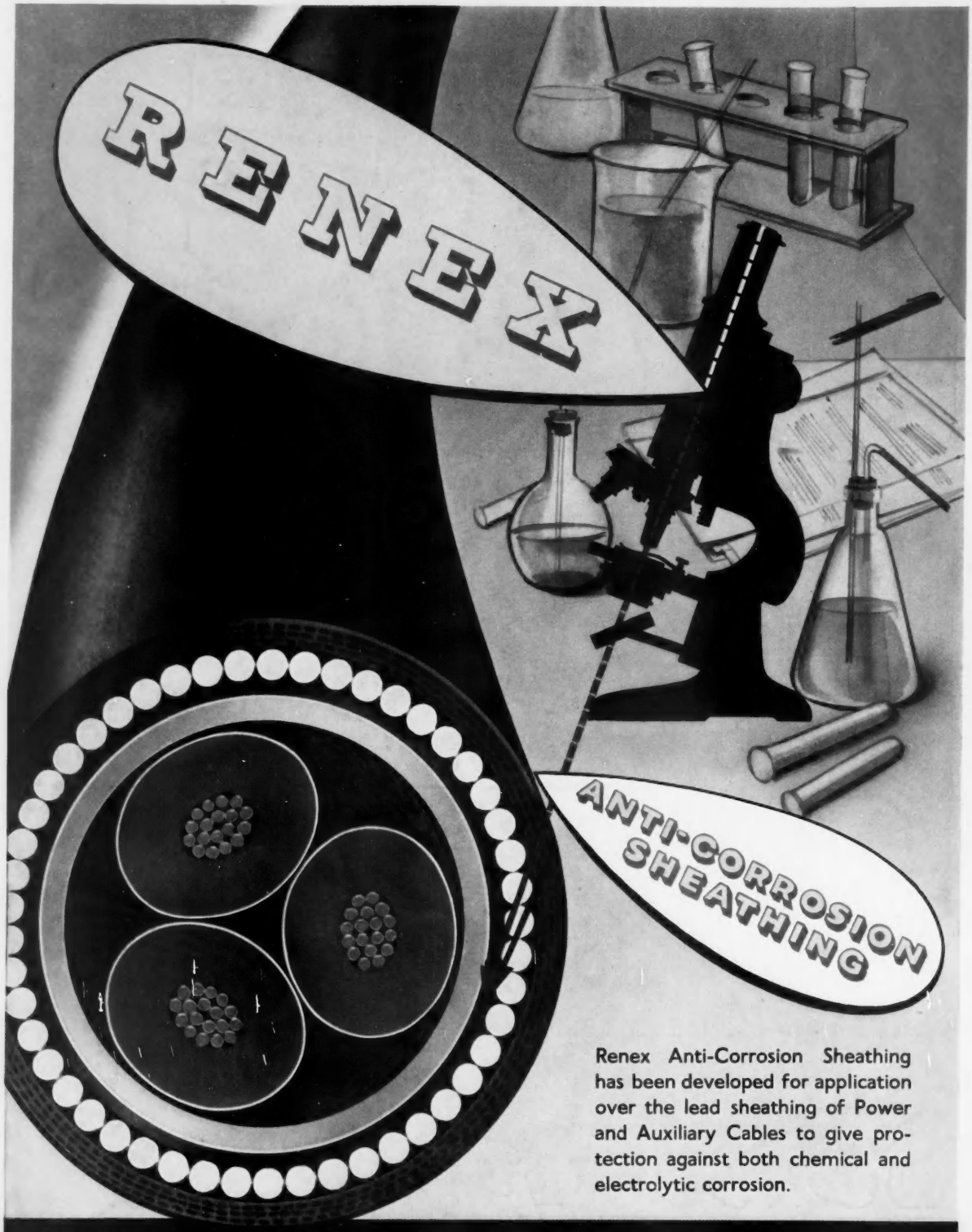

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